Vol. 37, No. 3 March, 1940

Psychological Bulletin

FACTORS AFFECTING COLLEGE GRADES: A REVIEW OF THE LITERATURE, 1930–1937

BY DANIEL HARRIS
New York City

INTRODUCTION

The writer has presented previously (**104**, pp. 5–15) a fairly comprehensive review of the experimental literature in this field up to 1930. The present summary brings this up to 1938, and, as in the previous summary, the findings are mostly simply set down under appropriate headings and allowed to speak for themselves.

Indicative of increased interest in these matters is the fact that the former review, covering a much longer period of time, included only 147 references, whereas the present one includes 328. The increase in number is striking, even though the figures as given are a bit exaggerated, due to the inclusion in the present summary of a number of studies published previous to 1930 but not included in the original summary, either through oversight or because the present summary includes certain aspects not originally considered.

INTELLIGENCE *vs.* HIGH SCHOOL GRADES *vs.* EXAMINATIONS, ETC.

Although more and more attention has been paid to factors other than intelligence, the importance of this factor is ever with us. Various investigators (**15**, **41**, **209**, **219**, **234**, **235**, **307**) report correlations with grades ranging from .33 to .64. At a number of places intelligence test scores were found to be the best single predictive device for grades (**98**, **209**, **249**, **263**, **299**).

But there are two other claimants to first honors, namely: high school grades, and content examinations of one sort or another.

High school grades were found to show a higher correlation with college grades than did intelligence, or anything else, by a sizable number of investigators (**64**, **79**, **85**, **121**, **124**, **234**, **235**, **268**, **310**). The correlations reported are mostly in the .60's and .70's, going

as high as .78 (85). Lincoln (148) and Crawford and Burnham (37) found high school grades better for prediction than entrance examinations. Hartson (107) found high school grades and intelligence to be of equal value. One study (122) found high school grades better than intelligence for predicting failures. In another (85) single high school subjects were found to have rather high predictive value for average college grades, r's ranging from .56 to .70.

There have been a number of investigations based upon *rank in high school graduating class* rather than high school grades. Drake and Henmon (56) found high school rank the best single predictive measure, and Root (227) found it the best precollege entrance predictive measure. In two places (11, 23) high school rank was found to be better than, or about equal to, high school grades. In another (78) high school rank correlated .69 with grades, which was a figure almost twice as large as the best correlation with the Minnesota College Aptitude Test.

Entrance examinations (1, 35), the Iowa High School Survey tests (88), and a composite placement test score (110) have each predicted grades better than intelligence tests. In the last case the r was .61. At Ohio State (202) the freshman placement tests were the best single predictive measure, while in some New York studies (62, 178, 283) the State Regents' examinations average was the best single measure. In two studies (7, 169) content examinations and intelligence tests were found to be about equally valuable.

English and reading tests alone have, in a number of places, been found to have high correlations (r's $= .36$ to $.60$) with total college grades (89, 178, 216). At Temple (96) intelligence, high school grades, and the coöperative English test were all found to have the same predictive value for grades ($r = .60$).

In addition to these precollege-entrance criteria, first-semester or first-quarter college grades have been found to be the best single criterion for prediction of later college grades (15, 200, 226). In one case (200) the r was .81. At Hamline (227) the freshman English grade alone turned out to be the best single criterion for grades in general ($r = .71$). In one apparently unique study (112) the *average college rank of former students coming with a similar record from the same high school* was found to give better predictive results than simple high school rank.

So far we have discussed single criteria. A good deal of attention has been paid to combinations of these same criteria in predicting grades, and almost every possible combination has been looked into.

High school grades combined with intelligence test score uniformly show higher correlations with grades than does either component separately (79, 122, 124, 209). Some other findings are indicated in Table I.

TABLE I

COMBINATIONS OF FACTORS

Reference No.	N	Factors	Relationship to Grades
108	Over 500	High school grades, intelligence, and ratings by principal and teacher	$R = .71$
263	122	High school grades, intelligence, and personality ratings	.71
254	(Not given)	High school grades, intelligence, and freshman grades	.87 (four years)
15	250	Second-year high school grades and intelligence tested in elementary school	.67 (first semester)
52	1200	High school grades and scholastic aptitude test	.63
99	756	High school grades and scholastic aptitude test	.71
169	583	High school grades and placement examination	.66
16	1825	High school grades, intelligence, and high school rank	.63 (freshman)
110	(Not given)	Intelligence, placement test, and Colgate B_3 scale	.66 (freshman)
242	149	Reading, English, immediate recall, and Beta-type tests	.70 (freshman)
227	(Not given)	Intelligence, high school rank, college aptitude test, and freshman English	.83
37	3277	High school grades, scholastic aptitude, mathematics aptitude, C.E.E.B. average, and age	.69 (freshman)

It can be seen that results vary in different places, and definite conclusions are not easy to reach. Segel (240), in a summary of over 100 studies, concludes that, for general prediction, general achievement tests are best (median $r = .545$), general mental tests next best (median $r = .44$), and specific tests of various sorts next (median $r = .37$).

PERSONAL DETAILS AND BACKGROUND

Age. As in the previous summary (104, p. 12), findings on the age factor are overwhelmingly to the effect that the younger students

get better grades; but it is worth noting that in most cases either no account is taken of intelligence (77, 129, 188, 210, 262, 279) or else, where intelligence is mentioned, the younger students are found to have the advantage (61, 98, 171). In the one study where intelligence was controlled by matching (233), no difference in the grades of the low and high age groups was found. In one study (258) students who received mid-term warnings were slightly older than average, but averaged lower on the psychological examination. In another (287) it was found that, with groups equated for Regents' average, both the under-age and over-age students did better than the middle group. In three studies (84, 161, 205) no relation was found between age and grades.

Sex. The preponderance of evidence here is again (see 104, p. 12) that women students get better grades than men students (14, 25, 110, 147, 152, 155, 287). In only two of the studies quoted, however, were groups equated for intelligence. One study (44) reports no sex differences in intelligence or grades. Another (18) found the women reliably higher on intelligence test scores, but only unreliably higher on grades. There should be mentioned in this connection a study (154) which suggests that male instructors are not as objective in grading women students as in grading men; although another (322) presents evidence that the sex of teachers or students plays little or no part in grades given.

Family Data. As before (see 104, p. 14), there are conflicting findings on position in, and size of, family (196, 210, 287, 301). At Purdue (210) the superior students more frequently than average had fathers who were professional men and less frequently had relatives who were Purdue alumni, but a number of other studies (18, 84, 110, 187, 196) agree in finding no relation between either paternal occupation or family college training and grades. Results regarding immigrant parentage are also conflicting (61, 110). In one study (42) a number of items on the Sims socioeconomic score card were found to correlate with grades to a much higher degree than they did with intelligence. In another (230) a grouping of students according to religious affiliation showed differences in average grades which were in some cases statistically reliable; but data on intelligence is not given.

Physical Data

Behrens (5) found among 292 probation students a higher percentage of physical or health handicaps than among a control group.

Other investigators (**110, 301, 307**), however, report negative or contrary findings.

It was found in a study of 353 men that with intelligence equal for both groups—in fact, with the smokers having a slight advantage—there was an indisputably reliable inferiority in the scholarship of the smokers. Further, among the smokers, those who inhaled were reliably inferior in scholarship to the noninhalers (**60**).

One study (**191**) found negligible intercorrelations among metabolic rate, vital capacity, blood pressure, and scholarship. Lauer and Evans (**141**), in a study of physiological changes resulting from experimental "startle" situations ($N = 50$), found that the return-to-normal time of the galvanometric reading correlated $-.09$ with intelligence and $+.35$ with grades; the amount of heartbeat change with exercise correlated $-.22$ with intelligence but $-.65$ with grades. At Purdue (**210**) the "distinguished" students averaged slightly heavier than average. At Michigan (**197**) Pillsbury claims to have found correlations as high as $+.29$ between semester grades and the asthenic body type, and uniformly lower grades among pyknics. Intelligence is not mentioned. The number of cases varied from 100 to 371.

Lorenz and McClure (**150**) found ($N = 811$) that the 9% who were color-blind (Ishihara) were slightly above average on intelligence and slightly below average on grades. At Bucknell (**102**), using an audiometer, no relationship between grades and auditory acuity was found. At Temple (**150**), using four groups of 25 students rated for beauty or physical attractiveness by two groups of 24 students from another college, the correlations were as follows: for girl subjects, beauty ratings correlated $+.22$ with intelligence and $+.28$ with grades; for boys, ratings correlated $-.08$ with intelligence and $+.18$ with grades.

In general, the recent findings do not bear out the positive trend indicated by the results on this topic previously reviewed (see **104**, pp. 12–13).

Personality, Interests, Attitudes

Ratings. Ratings on personality "traits" have again been found to correlate with grades in a number of instances, but interest in this type of study seems to have fallen off (see **104**, p. 7). Coefficients as high as .57 were obtained from combined ratings by high school principals and teachers on intelligence, attitude, industry, methods of study, etc. (**107, 108**). The correlation of these ratings

with intelligence or high school grades is not given. At Oregon (263) ratings on the American Council on Education Personality Report correlated .40 with scholarship, and adding in the ratings raised the multiple R of intelligence and high school grades with scholarship from .67 to .71. It was also found that ratings by friends on emotional steadiness correlated .30 with grades, intelligence not being mentioned (80); that "distinguished" students were rated above average on the Purdue Personnel Rating Scale (210); and that judgments by administrative officers correlated higher with grades (r's $=$ .54 to .64) than did intelligence or high school rank (133). In one interesting investigation (323), each member of the freshman class, at the end of the year, rated as many of his classmates as he felt he knew well enough on his degree of like or dislike for them. No appreciable relation appeared between scholarship and any of the following: number of classmates rated; number by whom rated; average degree of liking expressed for others; average rating received from others.

Personality Tests. Stalnaker (249) found the Laird C_2 (introversion) scale to predict grades to the extent that the average grade difference between extreme groups gave a D/σ_D figure of 2.8. Flemming (80) got a correlation of .26 with grades. In two other studies (95, 110) the same scale correlated zero, or practically so, with scholarship. The Pressey X-O test also showed no bearing on grades in two investigations (55, 95), although Flemming (80) claims a correlation of $-.29$ for his revision thereof, designed to measure emotional reliability or consistency. A sociability scale gave a low correlation ($r = -.25$) with grades for women students (44). Scores on none of the Bernreuter scales showed any but negligible bearing on grades (183, 274), although Stagner (248) found a D/σ_D of 2.51 on average grades between extreme groups on the self-sufficiency scale. He also notes that high-self-sufficient, high-dominant, and low-neurotic scoring groups show a better correlation between intelligence and grades than contrasting groups. At Buffalo (44) the highest and lowest quartiles (N's $=$ 25 and 23) of a freshman group on the Thurstone Personality Schedule were compared as to intelligence and grades. The well-adjusted group, according to the scale, tended to do a bit better on intelligence and a trifle poorer on grades. At Ohio Wesleyan (266) scores on various personality inventories and on the Ohio Wesleyan Personal History Record showed no substantial relation to scholarship (r's $= +.12$

to −.11). At Wisconsin (327) the same finding applied to the Bell Adjustment Inventory.

Interests. Using an interest test patterned after the Pressey X-O test, Drake (55) secured low correlations (.19 to .24) with grades. Young and Estabrooks (324, 325, 326), using a special scoring of the Strong interest blank, have recently evolved a studiousness scale which they find to predict grades at Colgate fairly well ($r = .35$), independent of intelligence. They point out (324) that the items most prognosticatory of studiousness, taken together, paint what closely resembles the accepted picture of the "introvert." Mosier (180) found this studiousness scale to predict grades quite well ($r = .55$) for a group of 42 arts students, but not so well (r's $= .29, .25, .19$) for somewhat larger groups of technical and business students. Williamson (314) found low correlations of .23 and .10, using two different groups of arts students.

Questionnaires. In a number of studies questionnaire material or items on tests which distinguished better from poorer students also point to the conclusion that what is commonly called "introvert" behavior is associated with better grades than its opposite (61, 183, 304).

Maladjustment. In one study (183) "non-achievers," *i.e.* those of high intelligence whose grades did not measure up to their indicated capacity, more often experienced conflicts about religion and life in general than did the "achievers" (of equal intelligence and better performance). The total number involved here was 118. And in another (304), among 1800 students, "discrepant failures"—high on intelligence but low on examinations—were compared with "discrepant distinguished" students—low on intelligence but high on examinations. The former were found to be more frequently handicapped by mental disabilities of the anxiety type. On the other hand, it was found (233) that younger students, although reporting more frequent "subjective" difficulties at college, earned grades equal to those of an older group matched for intelligence; and (204) that the clients of the student mental hygiene clinic showed no inferiority in academic performance.

Liberalism. In three studies (44, 62, 175) there was some relation between high grades and a tendency towards liberal or radical economic and social views, but in two cases there was also an intelligence advantage on the side of the liberals, while in the third intelligence was not noted.

High School Factors

Public vs. *Private Schools.* In a number of studies findings have indicated that public high school graduates do better college work than private school graduates (**4, 21, 131, 199, 217, 218**). In two of these (**4, 21**) the groups were equal in ability, and in one (**131**) the *private* school group was appreciably superior on college aptitude. It is pointed out in the same study, however, that students from certain private schools do superior work. In two other studies (**9, 110**) no superiority of public school entrants was shown, even though in one case (**9**) these students were, on the average, younger.

Subjects Taken in High School. Findings here are even less in favor of the "mind-training" subjects than in the previous summary (**104**, p. 10). Only one carefully controlled study (**246**), involving a large number of cases ($N = 1025$), showed definite superiority in freshman grades for those who had had Latin in high school, as against other foreign languages or no foreign language. In the case of Latin *vs.* German, the D/σ_D was 2.46.

Two other investigations found: a correlation between grades and the number of foreign language and mathematics units offered for entrance, and an inverse relation between grades and number of social or natural science units (**229**); and a similar positive relation for Latin and a negative one for history (**77**); but in neither case is any account taken of intelligence. At Northwestern (**24**) a correlation of .20 between grades and the amount of Latin taken in high school becomes .04 when intelligence is partialled out. At Nebraska (**319**) and Buffalo (**62**) Latin or Latin and mathematics in high school went with higher grades, but intelligence was also in favor of these groups.

The remaining investigations in this field (**51, 52, 109, 124, 184, 225**) all add up to the conclusion that no subject or combination of subjects, in any amount, has any noticeable bearing on grades.

Time Spent in and Since High School. A number of studies at the University of Buffalo (**260, 261, 262**), using groups carefully matched for intelligence and other factors, lead to the conclusions that (1) boys out of high school two years or more before entering college, and girls out one year or more, do superior college work; (2) girls who have done postgraduate work in high school before coming to college do better work than their controls, but boys do not; (3) graduates of high school in three years do no better than

their controls. The numbers involved in these studies were rather small, the largest in any one group being 65.

In other studies time out since high school graduation was not found to affect grades (110), and entrants direct from high school were found slightly inferior on grades (but also on intelligence) to transfers from other institutions (147).

Size and Location of High School. In two studies (164, 210) the superior students seemed to come more from large city high schools; but three others (50, 124, 195) do not bear this out, although in one of these (124) it was noted that grade prediction was more accurate for those from larger schools.

At Fisk (18) students from southern cities, while reliably inferior on intelligence test scores to those from northern cities, receive (unreliably) higher grades. In a study at Purdue (249) men from other states, although reliably superior to men from Indiana on intelligence test scores, and very definitely superior to them on high school grades, were not quite reliably superior to them on first-semester grades. At Buffalo (287) students from that city get better grades than students from elsewhere, with groups matched for Regents' average. At East Central Oklahoma Teachers College (161) urban *vs.* rural background had no bearing on grades.

Other Considerations. Wakeham (293) found that high schools which send a large proportion of their students to the university invariably show poorer average college grades for their students than those which send only a select few; while Jones (126) found an r of .28 between grades and the size of the answer to the question: "What per cent of your (high school) class intends to attend college this year?"

In two studies (92, 164) there was no relation between students' average grades and their schools being accredited or not accredited by the regional Association of Colleges and Secondary Schools.

At Buffalo (287) it has been noticed that students from certain Buffalo high schools do better than students from other Buffalo high schools matched for Regents' average; at Pittsburgh (110) no such local differentiation was found.

Sarbaugh (232) found that students who in high school repeated examinations, either to raise already passing grades or because of failure, were much superior in college work to a group matched for age, intelligence, and Regents' average.

At Oregon (50) the size of high school teachers' salaries correlated .01 with college grades.

It is easily seen that in recent years a good deal more attention has been paid to high school factors than previously (see **104**, pp. 14–15); and in the present writer's opinion this is sound procedure, even if findings are not yet very clear-cut.

Study Habits, Methods, etc.

Study Habits. A number of investigators, using questionnaires and inventories, have found that good students can be distinguished from poor achievers on the basis of specific study methods used, although not all findings agree on which methods characterize which group (**68**, **120**, **183**, **228**, **300**, **304**). It should be stated that in three of the studies mentioned (**68**, **120**, **300**) no account was taken of intelligence. Wrenn (**320**) has evolved a self-rating study-habits inventory which he found to distinguish sharply between students of high and low scholarship at Stanford, with intelligence equated. However, Reeder, at Ohio State, found the inventory of little value (**207**).

Counseling and How-to-Study Courses. In quite a number of places courses or counseling in proper study methods have shown gratifying results as measured by improved scholastic work (**34**, **38**, **65**, **90**, **170**, **228**, **296**, **316**). In one study (**297**) the interesting finding was that counseling of freshmen by senior students produced better results than counseling by instructors.

In two places (**5**, **63**) the effects of how-to-study courses, while observable, were slight. In a third (**162**) conferences with instructors and the dean by students doing poorly at mid-term seem quite beneficial to students in the upper two quintiles on intelligence, but not to those in the lower quintiles. In another (**306**) special training had a beneficial effect which, however, wore off after a year. Three studies (**83**, **128**, **312**) found counseling and special courses not to have any significant effects.

Reading Rate and Ability. That a relation exists between reading rate and comprehension, and college grades, has been pointed out by several investigators (**12**, **69**, **178**, **300**, **321**). In one of these studies (**12**) the relationship disappeared when intelligence was partialled out—and at Iowa State College (**140**) there was found an r of .205 between intelligence and reading rate—but in at least two of the studies mentioned (**69**, **321**) intelligence was definitely not a factor in the results obtained.

The possibility of improving reading ability thus seems a rather important question. Experiments on this point are unanimous in

their findings that reading ability of college students can be improved by special training (**43, 45, 140, 176, 177, 190, 223, 267**). In one study (**176**) improvement up to 150% (score on reading test) resulted from the remedial training.

Two investigators (**72, 177**) agree that poor readers' eye-movements involve longer fixational pauses and more frequent regressive movements. In another study (**189**) left-handed, ambidextrous, and shifted (as to handedness) students did, if anything, a bit better than average on the Minnesota Reading Examination.

Time Spent in Study, etc. A moderate positive relation between grades and time spent in study is reported from a number of places (**6, 29, 62, 161**). The highest correlation figure mentioned was .32, and holding intelligence constant raised the r to .38 (**6**). In one study (**91**) the relationship held for women students ($r = .28$) but not for men. In three others (**70, 118, 311**) no relation was found between grades and amount of time spent in study.

In one of the above (**70**) it was found, however, that those using the library got slightly better grades than those who did not use it at all; and at Ohio University (**151**) a library information quiz correlated .21 with point-hour ratio, intelligence constant. At the same institution, Stoke and Lehman (**257**), with one group of 72 students in a course in educational psychology, found that the number of assigned books actually checked out of the library correlated .49 with point-hour ratio for the semester. They had another group of 324 students state how often they had drawn out library books for preparing class assignments, and then checked by the signatures on library cards. They found that the percentage of overstatement, which ranged from 6% to 105%, was inversely related to grades. The authors suggest that dull students' overestimation or misrepresentation of their studiousness may be a common thing and may be the explanation for any findings of a negative relation between intelligence and industry among college students.

One investigation (**125**) found a positive r of .25 between grades and regularity of attendance at classes, intelligence constant.

All told, the studies on this topic add very little to the summary in the previous study (**104**, p. 6). The writer is inclined to agree with the conclusion of Uhrbrock (277) that ". . . the total pattern, or rhythm, of activities may be far more important than any single factor that may be isolated for study," and to add that the same probably applies to other topics in this survey.

Teaching Methods and Conditions

In three studies at Ohio State (**87, 172, 203**) sectioning gave good results in zoology and German classes. In two of the studies mentioned no account was taken of intelligence. At Purdue (**211**) sectioning in language classes produced no results large or consistent enough to justify the sectioning.

There have been three studies on the effect of weekly quizzes on grades in psychology courses, with conflicting results (**73, 134, 273**).

One group of sections in two courses in psychology met only two-thirds as often as the other, but was encouraged to do wider reading in the subject. Achievement tests showed no reliable differences resulting (**105**). Using control groups and courses in the three departments given by four instructors, students in classes meeting five times a week made greater gains than those in classes meeting three times a week; but the difference was reliable in only one of the four comparisons. The investigator points out that the subjects were mostly freshmen, that one-third of those in the three-times-a-week classes made greater gains than the average in the control classes, and that this one-third were predominantly superior students; and raises the question as to what the results would have been had the subjects been upperclassmen (**192**).

In 1928 Hudelson (**115**) had reported on a number of investigations on the effect of class size on grades. He concluded that, in general, no convincing relationship is shown, although in some experiments the results favored large classes. A carefully controlled experiment on mathematics classes (**213**) indicates, similarly, a tendency for large classes (43 to 54) to do slightly better than small classes (19 to 27), although student opinion in both small and large classes favored the smaller-sized class.

Investigations on the relative efficacy of the lecture *vs.* other teaching methods (**3, 92, 106, 149**) show no reliable differences.

Two studies (**76, 231**) on the relative merits of regular class meetings *vs.* independent study give contradictory results.

In an experiment repeated for two semesters (**243**), seniors who had one or two weekly periods for small-group discussions and directed study, instead of having regular "recitation" periods at all three class meetings, did better on objective tests throughout the semester (D/σ_D's = 1.49, 2.68) and considerably better on the final examination (D/σ_D's = 5.07, 2.18). The groups here were equated

for age, intelligence, freshman grades, practice-teaching scores, and personality ratings.

An experiment at Minnesota (**244**) found the project method in laboratory psychology decidedly preferable to the "regular" method for superior students but not for others. Another Minnesota study (**186**) established the following descending order of merit of class methods in an inorganic chemistry course, although no differences were entirely reliable: (1) three hours of laboratory, one hour of oral recitation; (2) five hours of laboratory; (3) three hours of laboratory, two hours of outside reading; (4) three hours of laboratory.

In one study (**318**) some slight but temporary effect on the achievement of those in the lowest decile and a half of the freshman intelligence distribution seemed to result from the institution of supervised study periods three afternoons a week. In another (**220**), with groups equated for intelligence and high school achievement, the supervised study hall produced reliably higher achievement than home study and unreliably higher achievement than dormitory-room study. Those with low mental ability benefited most from the supervised study. The total number of cases here was 151.

In an investigation (**185**) with classes in geography, nature study, and American government, and groups matched for placement test scores and instructors, classes with compulsory attendance showed some excess of achievement, for inferior students, over the optional-attendance class; but average and superior students did just as well under the optional plan.

In a study carried out in two Teachers Colleges (**39**) the regular method of outside assignments produced results superior to those obtained by confining all study to the classroom period.

Incentives and Direct Motivation

One 10-semester study (**144**) showed that, after the fraternity initiation academic requirements have been met, average grades tend to drop.

Superior students (upper quartile on grades) had overcome greater handicaps to obtain a university education than the inferior students (lowest quartile). However, they were also superior in intelligence (**61**). Students placed on probation for poor work tended to do better while on probation than previously (**69**). Of those sent mid-term warnings, some, of course, eventually passed, and others

finally failed; the former group had somewhat *lower* psychological test scores, had done slightly *better* on Regents', and carried *more* school and outside work than the latter group. Of those warned, those interviewed by the personnel director showed a lower percentage of eventual failures than those not interviewed, although averaging lower on mental test and carrying much more outside work (258). A number of positive stimulants to good scholarship were tried out on a freshman class, including an encouraging letter, an interview with the Junior Dean, reading lists, a letter of commendation to parents of all students doing outstanding work during the first quarter, an honor roll, and a scholarship dinner. The net result was an "unusually high" grade-point average for the entire group. There was no control group (59).

At Hunter College (8) recipients of State scholarships, over a long period of years, are reliably superior to nonrecipients on grades and other indices of academic achievement. Intelligence data is lacking. At the University of Melbourne (26) scholarship holders, picked on the basis of performance on the School Leaving Examinations for secondary schools, do definitely superior work. Again there is no data on intelligence. At Teachers College, Columbia (247), no significant differences in scholastic achievement were found between the following three groups: (1) 380 who received financial aid; (2) 541 who applied for aid but were rejected; (3) a control group of 1102.

A class of 196 students in a psychology course (75) was divided into two groups equated for intelligence and for score on an initial psychology achievement test. The experimental group was given monthly grades in terms of letters and deciles. The controls were simply told that their work was satisfactory, unsatisfactory, or failing. Both "A" students and those of low intelligence, in the experimental group, did considerably better work throughout the semester.

Student Load

Those who increased their course load from average to heavy at Ohio University (145) did somewhat better average work during the ensuing semester than those who decreased their course load from average to light. At Arkansas (114) students who either increased *or* decreased their load in a given semester tended to increase their grade-point average more than those who carried a constant course load. In this study those who decreased their load showed the greater gain. However, in the same group there were low positive correla-

tions (.11 to .32) between number of hours carried and grade-point average in each of the four quartiles of the intelligence distribution. At Chicago (**251**) it was found that the more comprehensive examinations a student takes during his first two years at the "College" the better on the average are his grades; but it is suggested that it is the more able students who take more examinations.

At Ohio State (**183**) the "achievers"—those whose point average percentile was higher than their intelligence percentile—carried fewer courses than the "non-achievers." At Buffalo (**163**) a study of adult students in the evening session found those carrying only one course to be below the entire group on a 10-minute opposites test, but above average on grades.

Two studies at Kentucky (**96**, 127) find no relation between student load and grades.

Extracurricular Factors

Fraternity Members vs. *Dormitory Residents, etc.* Results on the relationship of fraternity membership to grades are again (see **104**, p. 10) so utterly at variance with each other in the various studies (**14**, **19**, **153**, **156**, **167**, **208**, **249**) that one can only conclude that it depends entirely on the local situation and tradition. Students living in their own homes in a college town were found to be slightly superior in scholarship to students of approximately the same intelligence living in the dormitories (**100**). This study involved 1200 students and covered a period of three years. At St. Mary's College (**220**) resident students got better grades than those nonresident ($N = 151$).

Activities and Athletics. A number of studies at various places agree that participation in extracurricular activities goes together with high grades. In two of these studies there was also an intelligence superiority for the participating group (**166**, **171**); in two this was not the case (**58**, **183**); and in the fifth no mention is made of intelligence (**173**). In one (**58**) athletes receive lower grades than nonathletes.

In three studies there is agreement that athletes receive at least slightly lower grades than participants in other activities. One of these (**30**) involved 4500 seniors in a large number of Pennsylvania colleges, and groups were matched for intelligence; but none of the differences were statistically reliable. In another (**167**) the better students engaged in debate, publications, and departmental clubs, while musical and dramatic activities shared with athletics the onus of being associated with lower grades. In the third (**155**) it was

noted that men students got higher grades each year in the spring semester than in the fall semester for 10 years; this is attributed to the distracting effect of football during the fall. In two studies (61, 210) the better students (who are also more intelligent) expressed themselves as being less interested in athletics than did ordinary or inferior students. One investigation (18) found no relation between grades and athletics.

Outside Work. Here, also, findings are largely contradictory. In two studies (58, 277) outside work was found to be associated with low grades; but in a number of others (81, 173, 271, 286) the opposite finding is recorded. In only two of these studies (58, 286) were intelligence and other factors equated for the groups compared.

At Chicago (252) those students registered with the college placement bureau for part-time employment did reliably superior work (intelligence not mentioned). At Minneapolis (278) the conclusion is that moderate employment does not lower scholarship, but excessive employment does—at least for freshmen and sophomores. For upperclassmen, full self-support does not seem to be detrimental to grades. From Buffalo (258) comes the somewhat contradictory finding that, while students sent mid-term warnings put in more than average hours of outside work, nevertheless those warned who finally passed carried more outside work than those warned who finally failed. At Wittenberg (167) it was found that for women outside work went with lower grades, while for men the reverse was true.

Prediction for Specific Subjects [1]

TABLE II

English, Physics, Chemistry, Zoology, Botany

Reference No.	N	Predictive Factor	Relationship to Grades
English			
284	661	Regents' average	r=.60
96	120	Coöperative English test	r=.63
290	661	Regents' average Coöperative English test	Equal in value.
305	4000	C.E.E.B. English test	r=.39
136	300	Iowa English placement test	r=.63 (predicted 33% of grades precisely)
165	*	Four subtests of above	All equally valuable.
216	1750	Carnegie English test	r=.48
256	183	Iowa English placement tests	r=.65

[1] For convenience, much of the following material is presented in tabular form.

TABLE II—*Continued*

Reference No.	N	Predictive Factor	Relationship to Grades
253	275	English placement test	r=.49
		Psychological examination	r=.52
		Both of above, plus English theme test	R=.61
37	3277	Language aptitude test	r=.55
249	1034	English training test	r=.60
85	272	High school English grades	r=.64
16	687	Number of high school language courses	r=.23
2	*	Intelligence	Four times as valuable as English placement test.
30	76	Intelligence	Most important factor. Other factors — previous preparation in English, knowledge of the fundamentals, time spent in studying English—all had very little bearing on grades.
Physics			
288	661	Regents' in chemistry, physics, or trigonometry	r's=.55 to .58
305	4000	C.E.E.B. physics test	r=.41
Chemistry			
186	350	Having had high school chemistry	Makes for initial superiority, which later disappears.
293	2026	Having had high school chemistry	Grades 12% higher.
		Having had high school chemistry and physics	Grades 24.5% higher.
292	3268	Having had high school chemistry	None.
		Having had high school chemistry and physics	Grades 2.5% higher.
		High school average grades	High r (unspecified)
249	1034	Chemistry aptitude test	r=.55
256	183	Iowa chemistry placement tests	r=.59
215	180	Iowa chemistry placement tests	r=.57
		Ohio psychological examination	r=.42
		Combination of chemistry and intelligence tests	R=.57
Zoology			
20	62	Having had high school zoology	A temporary initial advantage.
288	661	Iowa content test—science	r's=.55 to .61 (best predictive measure)
Botany			
264	202	Merely labeling ready-made specimen drawings, instead of making own drawings	Reliable superiority.
110	(Not given)	Ruch-Crossman biology test	r=.56

* See note, Bibliography.

Physical Sciences. At Buffalo (284) Regents' average correlated .46 with grades in the physical sciences. At Lafayette (225) students got reliably higher grades in college in a science (biology, chemistry, or physics) which they also took in high school. One study in Detroit (221) found that men students did markedly better in geology than girls; but at Wooster (281) women did slightly better in geology than men (intelligence not noted).

In one study (295) the science-mathematics scale of the Minne-

TABLE III

PSYCHOLOGY, MATHEMATICS

Reference No.	N	Predictive Factor	Relationship to Grades
Psychology			
257	324	Number of assigned books checked out of library	r=.42
135	75	Reason given for taking the course	Genuinely scholastic aims go with higher grades (differences not reliable).
265	51	Van Wegenen reading scale	r=.72
		Iowa silent reading test	r=.63
94	552	Having had a course in zoology	Almost reliable superiority, intelligence constant.
48	*	Miner's interest blank	Differentiates reliably between A and B *vs.* D and E students.
Mathematics			
67	(Not given)	Algebra test (half hour)	Both equally valuable (figures not given).
		High school record	
194	400	Iowa mathematics training test	r's as high as .74
		Iowa chemistry aptitude test	.66
		Purdue personality rating scale	.52
		A.C.E. psychological examination	.51
		Purdue placement test in English	.32
54	387	Percentile rank, A.C.E.	r=.26
		High school mathematics grades	r=.46
		Average high school grades	r=.47
249	1034	Mathematics aptitude test	r=.53
37	3277	Mathematics aptitude test	r=.66
		C.E.E.B. mathematics test	r=.25
305	4000	C.E.E.B. mathematics test	r=.33
256	183	Iowa mathematics placement tests	r=.59
284	661	Regents' average	r=.39
85	272	High school mathematics average	r=.50
66	831	Knowledge of mathematical terms	r's=.59 and .64
		Intelligence test	r's=.58 to .85

* See note, Bibliography.

sota interest blank was found to show a significant, though low, *r* with achievement in related fields. One writer (**46**) concludes from studies by various investigators that mathematics does not require specialized ability.

Languages. Williams (**309**) found that students got better language grades when they had the same language in high school; and, where there was no time gap between high school and college study of the same language, the grades were even better. Wagner and Strabel (**289**) found the Regents' *average* to afford the best index to success in any given language. It was also found here that grades in languages were more easily predicted than grades in any other field. But Held (**110**), with a composite placement test score, secured a correlation of .45 with foreign-language grades, which is less than the *r* with any other subject.

In a study embracing seven eastern colleges, Whitman (**305**) found that the C.E.E.B. examination in French correlated .47 with French grades. At Oregon (**54**) high school *mathematics* grades gave an *r* of .46 with French marks. At Pittsburgh (**110**) the French C.R.B. test correlated .34 with French grades. This figure was the lowest for any subject predicted by an appropriate placement test at this institution. A seven-year study (**302**) found that training in Latin was related to better work in French composition and certain other fields in which knowledge of Latin is used directly. At Minnesota (**282**) it was concluded, after trying various measures, that the Iowa Foreign Language Aptitude Test was the best single predictive measure for college German grades (correlations, .38 to .49). At Case (**256**) the Iowa French Training Test correlated .79 with first-semester French grades.

Other Subjects. Two studies (**74**, **110**) agree on the value of the Seashore tests for musical talent for predicting grades in music courses. In one of them (**110**) 100% of those in the lowest quartile on both musical talent and psychological test did unsatisfactory work in music.

Whitman (**305**) found that the C.E.E.B. examination in ancient history correlated .26 with grades in that subject. At Pittsburgh (**110**) composite placement test score correlated .56 with freshman history grades—the highest figure for any subject at this institution. Garrett (**85**) found high school average in history correlated .67 with college history. At Buffalo (**284**) Regents' average correlated .56 with grades in the social sciences. At Oregon (**53**) grades in history and social sciences were harder to predict than in any other subject and were not affected at all by the number of high school units in these subjects.

At Oregon (54) high school mathematics correlated .21 with grades in philosophy. Brown (13) found a multiple R of .59 with grades in a home economics course, based on an initial content examination, intelligence, honor-point ratio, previous study of foods, and estimate on home experience in food preparation.

In General. It can be seen that there is no unanimous agreement as to the relative ease of prediction for specific subjects or the relative merit of any kind of predictive factor (*e.g.* high school grades in a specific subject) as compared with any other. In this connection, Segel (240), in his summary of a large number of investigations, comes to the conclusion that, for predicting scholarship in specific subjects, specific aptitude or achievement tests are best. At Buffalo (285) the conflicting finding is reported that Regents' average not only is the best predictive measure for grades in general but will predict specific field grades as well as, or better than, aptitude or achievement tests or anything else. With regard to previous high school work in a field, a study at Wisconsin (16) found that with one exception, English, there was no relation between the number of semester hours of high school work in any field and college grades in the same field.

In three studies (22, 137, 214) a definite relation was found between expressed preference for a subject and good grades in that subject. Chauncey (22) found that biserial r's between preference and achievement ranged between .50 and .76 for different subjects. At Minnesota (279) correlations as high as .41 (for English) were obtained between interest scores worked out for various subject fields, based on the Minnesota interest blank, and grades in those subjects.

Differential Prediction. There have been a number of studies concerned with predicting not specific grades as such, but the *difference* between grades, *e.g.* whether a given student is going to do better in mathematics than in languages, or vice versa. Various criteria have been investigated, including achievement tests (238) and various parts of the A.C.E. psychological examination (241); but Segel (239), who has done most of this work, claims to have secured the best results by using various vocational interest scores based on the Strong interest blank. He reports r's as high as .61, using a formula described in another article (142). (Using multiple r's based on more than one Strong factor, he reports r's as high as .87 in predicting differential achievement in the various parts of the Iowa content examination. The number of cases in this study, however, was only 100.)

More or less related to this topic is the finding (259) that freshmen who entered after postgraduate work in high school, while not differing from matched control groups on average grades, did better than the controls in social sciences and poorer in mathematics.

A study (143) investigated the relative predictive value, for different courses, of the five subtests of the Thorndike Intelligence Examination for High School Graduates. These are: (1) reading comprehension; (2) linguistic ability; (3) mathematical ability; (4) following printed directions; and (5) general information. Subtests (2) and (3) were found to have great predictive superiority over the others, each in its appropriate field.

At Yale (36) predicted and actual grades correlated very highly for "verbal" subjects (English, history, languages; $R = .62$) and for "quantitative" subjects (mathematics, chemistry, physics, mechanical drawing, biology; $R = .67$), the two predictive formulae being based on weighted combinations of high school rank and appropriate entrance examination scores.

Curricula and Occupational Choice

Remmers (210) found "distinguished" students to be more often than others in the schools of agriculture, chemical engineering, or science. Fritz (84) found no relation between curriculum and grades. In another study (111) those preparing to teach in the grammar grades ranked highest, and the kindergarten-primary majors ranked lowest. Here, however, there were parallel intelligence differences, and none of the differences were reliable. Eckert's results (62) showed the students in the upper-grade quartile to be more interested in teaching as a vocation than those in the lowest quartile, but also higher in intelligence test score. Eurich (71) found that arts students failed most frequently in physics and beginning French, while education students most commonly failed in psychology.

An analysis of the A.C.E. psychological examination and its subtests (179) led to the conclusions that (1) the subtests measure abilities independent of the ability measured by the total test; (2) the completion and opposites tests measure abilities needed in liberal arts and social sciences; (3) the arithmetic test measures abilities needed in natural sciences and law; and (4) the opposites test measures ability important in scientific work. A somewhat similar study (291) failed to show that varying the weights assigned to specific subtests of the A.C.E. examination improved the prediction of grades in either the engineering, agricultural, or general divisions of the college.

In studies at Franklin and Marshall, Ohio State, and the University of London (**160, 183, 304**) definiteness of vocational choice goes with higher grades. On the other hand, studies at Chicago (**328**) and Minnesota (**315**) and a State-wide survey in Illinois colleges (**187**) all fail to find any superiority of grades to go with definiteness of vocational choice. In the Chicago study, based on over 2000 cases, those who had chosen an occupation did show some advantage in grades, but this disappeared when intelligence was held constant. In the Minnesota study ($N = 860$) it was found that, among the women students, those with an occupational choice received *lower* grades, although this difference was not quite reliable.

These inconclusive results on vocational choice are in accord with the previous findings (**104**, pp. 10–11).

Prediction for Professional Curricula and Schools

TABLE IV

Teaching *, Law, Medicine, Dentistry

Reference No.	N	Predictive Factor	Relationship to Grades
Teaching *			
82	70	Army Alpha	$r = -.03$ } (student teaching)
	82	Thurstone intelligence	$r = .35$ } (student teaching)
132	840	Combination of intelligence, reading, and vocabulary tests	$R = .49$ (women) } (professional grades)
			$R = .64$ (men) } (professional grades)
307	780	Intelligence	$r = .33$ } (professional grades)
		Physique	$r = .08$ } (professional grades)
49	135	Cox-Orleans prognosis test	$r = .39$ (student teaching)
119	94	Admission on basis of "special examination on intellectual, emotional, and social traits," in lieu of ordinarily required Regents' average	Do a bit poorer in practice teaching—intelligence not considered.
198	761	Precollege teaching experience	$r = .26$ (men) } (student teaching)
			$r = .05$ (women) } (student teaching)
		Age	No effect. } (student teaching)
		Intelligence	No effect. } (student teaching)
		Academic grades	$r = .09$ (men) } (student teaching)
			$r = .40$ (women) } (student teaching)
272	750	Previous teaching experience	Do a bit better in student teaching; no difference in educational theory.
Law			
86	Entire freshman class	Ferson-Stoddard law aptitude examination	$r = .54$ with first-year law grades. Intelligence not controlled.
117	(Not given)	Combination of undergraduate grades, intelligence, Yale legal aptitude test	$R = .64$ with four-semester law grades.

TABLE IV—*Continued*

Reference No.	N	Predictive Factor	Relationship to Grades	
				% Failures Predicted
Medicine				
181	6000	Moss medical aptitude test		69
		Grades in premedical subjects		43
		Interview ratings by medical school admissions committees		33
		Semester hours of premedical credit		22
		Combination of first two, above		73
33	45	Moss medical aptitude test	r=.64	
		Thorndike intelligence test	r=.62	
		Premedical grades	r=.67	
		Moss medical aptitude and premedical grades	R=.761	
		Combination of all three, above	R=.764	
Dentistry				
224	30	Downey will-temperament test	r's=.27 to .38	(freshman)
		Age	r=.48	(freshman)
	50	Downey will-temperament test	r's=.09 to .17	(senior)
		Age	r=—.20	(senior)
237	90	Miles two-story duplicate maze	r's=.09 to .33	
103	66	Five mechanical ability tests (Wiggly block, finger and tweezer dexterity, hand steadiness, wax carving)	r's=.15 to —.17	
		Otis S-A intelligence test	r=.55 (first-year grades)	
			r=.35 (four-year grades)	
		Predental average grades	r=.44 (first-year grades)	
			r=.53 (four-year grades)	
		Science predental grades	r=.41 (first-year grades)	
			r=.59 (four-year grades)	
		Otis plus science predental grades	R=.67 (four-year grades)	

* Previous sections have taken up prediction of academic grades in Teachers Colleges. This section is limited to practice teaching and other strictly professional courses.

Whipple (303) reports an unpublished experiment wherein the simple task of sharpening a lead pencil with a knife "in a neat and workmanlike manner"—the result being graded by comparison with a series of sharpened pencils of varying degrees of neatness and workmanship—was the one test of many tried which completely dis-

tinguished between two groups of dental students rated as "first-class" and as "distinctly poor" in operative skill. Numbers and details are not given. Some German experiments (**158, 159, 236**) report correlations of .73 to .83 between professors' ratings of dental students and scores in several tests of manual steadiness and dexterity. Small groups ranging from 12 to 20 in number were used.

TABLE V

ENGINEERING

Reference No.	N	Predictive Factor	Relationship to Grades
101	8000	Iowa chemistry placement examination	r's=.23 to .63 (first-semester grades)
		Iowa placement examinations, total average	R=.67 to .75 (freshman grades)
136	300	Iowa training tests average	R=.52
		Iowa aptitude tests average	R=.39 (first-quarter grades)
		Mathematics training test	r=.54
116	162	Pre-engineering physics	r=.57
		All pre-engineering courses	R=.52
		Pre-engineering chemistry	r=.45
		Pre-engineering mathematics	r=.40
113	(Not given)	A.C.E. psychological examination	r=.55
		Iowa silent reading test	r=.39
		Engineering interest, Strong	r=.32
		Stenquist mechanical aptitude, No. 2	r=.43
		Stenquist, No. 1	No relation.
		Stenquist Assembly, I	No relation.
		Thorndike word knowledge test	No relation.
		Ascendance (A-S blank)	r=−.40
157	1100	Missouri (Mann) drawing aptitude test	r's=.63 to .81 (grades in engineering drawing)
		Iowa placement tests and Strong interest test	R's=.50 to .77 (in various specific subjects)
317	107	Otis advanced intelligence test	r=.40
		Freshman mechanical drawing	r=.45
		Freshman engineering grades	r=.58 (advanced engineering grades)
		Freshman mathematics grades	r=.63
		Combination of all four, above	R=.69

Various. At a training school for nurses (**219**) the following measures were correlated with practice and theory grades of 48 first-year students: (1) Stanford-Binet; (2) A.C.E. psychological examination; (3) Moss social intelligence test; (4) Moss nursing aptitude test; and (5) Bernreuter blank. None of these had any appreciable r's with practice grades. With theory grades, their r's were as follows: (1) .37; (2) .62; (3) .30; (4) .62; with intelligence constant, .26; (5) negligible.

At a school of social work (168) the following factors, based on a study of 530 entrants over a 12-year period, were found to distinguish groups between whose average grades the differences were statistically reliable: (1) college graduation; (2) number of undergraduate courses in sociology and the social sciences. Data on intelligence is not presented. The following had no bearing on achievement: (1) undergraduate activities; (2) interval between college graduation and entrance to the school; (3) size of home community.

One study (245) found that, except for law, college preprofessional language grades are not related to subsequent grades in the professional schools.

Miscellaneous

Prediction of grades has a number of times been found easier or more accurate for some groups of students than for others. Three studies (78, 283, 287) found prediction better for women students than for men, while one (50) found no increase in accuracy of prediction to result from considering men and women separately. Two of the studies (283, 287) also indicate that prediction is better for homogeneous groups in general, *e.g.* as to age, sex, school. This contradicts a previous finding (104, p. 16). Another finding (287) was that prediction is better for those with high Regents' average and for those with high motivation.

In one investigation (10) students in psychology classes estimated their own course grade before taking the final examination and again after the examination. The correlations with the actual grades were .66 and .74. The same students had rated their instructor, on a six-point scale, on his ability to teach. There was no relation between estimated or actual grades and ratings of the instructor. In another (28), involving three instructors, it was found in the case of one instructor that knowledge of his students' scores on a previous intelligence test produced a statistically reliable effect on the grades he gave them. Mention has already been made (see p. 144: *Prediction for Specific Subjects: In General*) of the relation between preference for a subject and grades in it. In one of the studies quoted (214) it was noted that attitudes toward subjects varied significantly with the instructor involved.

Grades in correspondence courses correlated .58 with grades in residence work (138).

It is pointed out (15) that academic failures are easier to predict

than successes, the explanation being that a lack is hard to remedy, while an ability is easy to neglect. An analysis of probationers (201) led to the conclusion that in no case was it a single cause, but rather a constellation of troubles (study habits, social difficulties, emotional, vocational adjustment) which, in combination, caused the unsatisfactory work.

Mentioned previously (see *Extracurricular Factors: Activities and Athletics,* p. 139) was the improvement in spring grades for men students (155), attributed to the absence of fall football distractions. In a study (14) based on 7000 students of both sexes over a period of eight semesters, there was found a marked tendency for the grades of *all* groups to be higher in the second semester of the year than in the first. In another (222) there was a similar finding. Here it was noted that third-semester grades are the low point of the entire college career of both engineering and arts students ($N = 200$); and this is attributed to the distractions of the social development and maturation which allegedly take place at this period of college students' lives. One investigation (226) notes that the r between January grades and the following June grades is a bit higher (.79) than that between June grades and the following January grades (.72).

A study at Minnesota (313) found that from 1929 to 1935 there was a rather steady decline in the correlation between scores on the college aptitude test and scholarship, for men in the College of Science, Literature, and the Arts, from an r of .40 to one of .19. A number of possible explanations are suggested, one of them being *the efficiency of the personnel counseling system* at Minnesota.

Jones (123) maintains that the higher the correlation between university grades and intelligence test scores the greater must be the scholastic motivation of the students. He points out that at Buffalo the correlation has increased with the institution of a number of administrative measures designed to encourage and reward good work. Along this line it was found (31) that the correlation between Alpha and marks on an expected final examination was .52, while with quizzes sprung without notice the r was only .06. And another study (298) leads to the conclusion that drive is the most important factor in the success of students.

Concluding Note

The writer has been reluctantly forced to the conclusion that his previous summary has not been widely read or seriously pondered upon by the fact that he finds so many investigations since that date

still suffering from the faults he then castigated (see **104**, p. 15), namely: (1) heterogeneity of subjects; (2) failure to hold intelligence constant; and (3) failure to present results in terms of statistical reliability.

It is the writer's personal opinion, unsupported by anything resembling a regression equation and based merely on his own findings, total immersion in the results and opinions of other investigators, and some cogitation, that the essential factors in student achievement are, in the order of their importance:

(1) *Ability* (or intelligence, or scholastic aptitude, etc.).

(2) *Effort* (or drive, or degree of motivation, etc.).

(3) *Circumstances* (personal, social, economic, academic, etc.).

BIBLIOGRAPHY

1. Arlitt, A. H., & Hall, M. Intelligence tests versus entrance examinations as a means of predicting success in college. *J. appl. Psychol.*, 1923, **7**, 330–338.

*2. Asher, E. J. Relative weights of intelligence and English tests in predicting grades. *Kentucky Person. Bull.*, 1934, No. 11.

3. Barnard, W. H. Note on the comparative efficacy of lecture and socialized recitation method *vs.* group study method. *J. educ. Psychol.*, 1936, **27**, 388–390.

4. Beatley, B. The relative standing of students in secondary school, on comprehensive examinations, and in college. *Sch. Rev.*, 1922, **30**, 141–147.

5. Behrens, H. D. Effects of a "how to study" course. *J. higher Educ.*, 1935, **6**, 195–202.

6. Bell, H. M. Study habits of Teachers College students. *J. educ. Psychol.*, 1931, **22**, 538–543.

7. Bell, W. J. Prognostication of college marks by tests of intelligence and of high school content. *Proc. Ia Acad. Sci.*, 1935, **42**, 174–175.

8. Bildersee, A. State scholarship students at Hunter College of the City of New York. *Teach. Coll. Contr. Educ.*, 1932, No. 540.

9. Blakeslee, C. S. A comparative study of the college achievement of public, private, and public and private school entrants. Unpublished Master's Thesis, Department of Education, Univ. Chicago, 1929. [Quoted from Koos (**131**).]

10. Blum, M. L. An investigation of the relation existing between students' grades and their ratings of the instructor's ability to teach. *J. educ. Psychol.*, 1936, **27**, 217–221.

11. Boucher, C. S. Freshman admissions at the University of Chicago. *Educ. Rec.*, 1933, **14**, 74–80.

* All items preceded by an asterisk refer to journals which were not available to the writer, and references thereto are quoted from *Psychological Abstracts.*

12. Broom, M. E. A note on silent reading comprehension and success in academic achievement in a State Teachers College. *J. appl. Psychol.*, 1934, **18**, 561–565.
13. Brown, C. M. An experiment in sectioning. *J. higher Educ.*, 1930, 1, 269–273.
14. Byrns, R. Concerning college grades. *Sch. & Soc.*, 1930, **31**, 684–686.
15. Byrns, R. K. Scholastic aptitude and freshman achievement. *Sch. & Soc.*, 1932, **35**, 713–718.
16. Byrns, R., & Henmon, V. A. C. Entrance requirements and college success. *Sch. & Soc.*, 1935, **41**, 101–104.
17. Byrns, R., & Henmon, V. A. C. Long range prediction of college achievement. *Sch. & Soc.*, 1935, **41**, 877–880
18. Caliver, A. A personnel study of negro college students. *Teach. Coll. Contr. Educ.*, 1931, No. 484.
19. Carter, T. M. The effect of college fraternities on scholarship. *J. appl. Psychol.*, 1934, **18**, 393–400.
20. Cederstrom, J. A. The influence of a secondary course in zoology upon gains in college zoology. *J. educ. Res.*, 1931, **24**, 57–61.
21. Chamberlain, L. M. Comparisons of achievement. *J. higher Educ.*, 1933, **4**, 15–18.
22. Chauncey, M. R. The educational and occupational preferences of college seniors. *Teach. Coll. Contr. Educ.*, 1932, No. 533.
23. Clark, E. L. High school average versus high school class rank as means of predicting college grades. *Sch. & Soc.*, 1931, **34**, 765–766.
24. Clark, E. L. Amount of high school Latin as an indicator of success in college work. *Sch. & Soc.*, 1932, **35**, 189–190.
25. Cockerell, T. D. A. The relative ability of men and women. *J. Hered.*, 1934, **25**, 163–164.
26. Collmann, R. D., & Jorgensen, C. The prediction of scholastic success. New York: Stechert, 1935.
27. Connor, R. The scholastic behaviour of a selected group of undergraduate home economics students. *Teach. Coll. Contr. Educ.*, 1931, No. 497.
28. Constance, C. L. Instructors' use of mental test scores. *J. educ. Res.*, 1932, **25**, 40–41.
29. Converse, P. D. Time-studies in the university. *J. higher Educ.*, 1931, **2**, 258–262.
30. Cooper, J. A. The effect of participation in athletics upon scholarship measured by achievement tests. *Penn St. Stud. Educ.*, 1933, No. 7.
31. Corey, S. M. The effect of motivation upon the relationship between achievement and intelligence. *Sch. & Soc.*, 1935, **41**, 256–257.
*32. Cowdery, K. M. Entrance qualifications and Stanford scholarship. *Fac. Bull., Stanford Univ.*, 1935, No. 20, 1–2.
*33. Cowdery, K. M., & Ewell, B. C. Aptitude for Medical School success. *Fac. Bull., Stanford Univ.*, 1931, No. 19, 3–4.
34. Cowley, W. H. An experiment in freshman counseling. *J. higher Educ.*, 1933, **4**, 245–248.
35. Crane, E. An investigation of three plans for selecting the students to be admitted to college. *J. educ. Psychol.*, 1926, **17**, 322–330.

36. CRAWFORD, A. B. Individual differences in educational guidance. *Psychol. Monogr.*, 1936, **47**, No. 212, 148–172.
37. CRAWFORD, A. B., & BURNHAM, P. S. Entrance examinations and college achievement. *Sch. & Soc.*, 1932, **36**, 344–352; 378–384.
38. CROMWELL, O. Preparation for freshman composition. *Engl. J.*, 1936, **25**, 551–556.
39. CROW, L. D. The comparative value of extra-classroom study in the learning of educational psychology. *J. educ. Res.*, 1930, **22**, 215–218.
*40. CUFF, B. C. Relationship of socio-economic status to intelligence and scholarship. *Kentucky Person. Bull.*, 1933, No. 9, 4.
41. CUFF, N. B. Prognosis and diagnosis of success in college. *J. appl. Psychol.*, 1930, **14**, 612–619.
42. CUFF, N. B. The vectors of socio-economic status. *Peabody J. Educ.*, 1934, **12**, 114–117.
43. DANNER, W. M. Silent reading in college groups coached by rhythmic auditory pacing technique. (Abstract.) *Psychol. Bull.*, 1935, **32**, 532.
44. DARLEY, J. G. Scholastic achievement and measured maladjustment. *J. appl. Psychol.*, 1937, **21**, 485–493.
45. DEAL, R. W. The development of reading and study habits in college students. *J. educ. Psychol.*, 1934, **25**, 258–273.
46. DEXTER, E. S. Does mathematics require specialized endowments? *Sch. & Soc.*, 1936, **44**, 220–224.
47. DILLEY, F. B. Scholastic records of students failing a general intelligence test. *Sch. & Soc.*, 1931, **33**, 311–314.
*48. DIMMICK, G. B. Interest inventories of psychology students. *Kentucky Person. Bull.*, 1935, No. 15.
49. DODD, M. R. A study of teaching aptitude. *J. educ. Res.*, 1933, **26**, 517–521.
50. DOUGLASS, H. R. The relation of high school preparation and certain other factors to academic success at the University of Oregon. *Univ. Ore. Educ. Ser.*, 1931, **3**, No. 1.
51. DOUGLASS, H. R. Selecting good college risks. *Sch. & Soc.*, 1932, **35**, 140–147.
52. DOUGLASS, H. R. Selecting college entrants. *J. higher Educ.*, 1932, **3**, 179–184.
53. DOUGLASS, H. R., & FRIEDMAN, K. C. The relation of certain factors to achievement in college social studies and history. *Sch. Rev.*, 1937, **45**, 196–199.
54. DOUGLASS, H. R., & MICHAELSON, J. H. The relation of high school mathematics to college marks and of other factors to college marks in mathematics. *Sch. Rev.*, 1936, **44**, 615–619.
55. DRAKE, C. A. A study of an interest test and an affectivity test in forecasting freshman success in college. *Teach. Coll. Contr. Educ.*, 1931, No. 504.
56. DRAKE, L. E., & HENMON, V. A. C. The prediction of scholarship in the College of Letters and Science at the University of Wisconsin. *Sch. & Soc.*, 1937, **45**, 191–194.
57. DRAKE, R. M., & WINN, E. Measuring student efficiency. *Bull. Amer. Ass. Coll. Registr.*, October, 1935.

58. DUNKELBERGER, G. F. Do extra-curricular activities make for poor scholarship? *J. educ. Sociol.*, 1935, **9**, 215–218.
59. DUPREE, H. Encouraging the superior freshmen students in the College of Arts and Sciences. *Bur. educ. Res. Monogr.*, 1932, No. 15, 221–230.
60. EARP, J. R. The student who smokes. (2nd ed.) Yellow Springs, O.: Antioch Press, 1926.
61. ECKERT, R. E. Who is the superior student? *Univ. Buffalo Stud.*, 1934, **9**, 11–50.
62. ECKERT, R. E. Analyzing the superior college student. *Sch. & Soc.*, 1935, **41**, 69–72.
63. ECKERT, R. E., & JONES, E. S. Value of a "how to study" course for college students. *Univ. Buffalo Stud.*, 1935, **10**, No. 2, 1–46.
64. EDDS, J. H., & MCCALL, W. M. Predicting the scholastic success of college freshmen. *J. educ. Res.*, 1933, **27**, 127–130.
65. EDMISTON, R. W. The effects of emphasizing "how to learn" upon knowledge of course content and school marks. *J. educ. Psychol.*, 1937, **28**, 371–381.
66. EDWARDS, A. S. A mathematics vocabulary test and some results of an examination of university freshmen. *J. educ. Psychol.*, 1936, **27**, 694–697.
67. ELVEBACK, M. L. The progress of general college students in mathematics. (Abstract.) *Psychometrika*, 1937, **2**, 67–68.
68. EURICH, A. An analysis of self-ratings on studiousness traits. *J. appl. Psychol.*, 1930, **14**, 577–591.
69. EURICH, A. Improvement in scholarship during the probationary period. *Sch. & Soc.*, 1932, **35**, 129–134.
70. EURICH, A. The significance of library reading among college students. *Sch. & Soc.*, 1932, **36**, 92–96.
71. EURICH, A. College failures. *Sch. & Soc.*, 1933, **37**, 692–696.
72. EURICH, A. The photographic eye-movement records of successful and unsuccessful college students. *J. appl. Psychol.*, 1933, **17**, 604–613.
73. EURICH, A. The effect upon student achievement in psychology of weekly examinations and of stress upon improvement. (Abstract.) *Psychol. Bull.*, 1936, **33**, 803–804.
74. FARNSWORTH, P. R. Are music capacity tests more important than intelligence tests in the prediction of several types of music grades? *J. appl. Psychol.*, 1935, **19**, 347–350.
75. FAY, P. J. The effects of knowledge of grades on subsequent achievement of college students. (Abstract.) *Psychol. Bull.*, 1933, **30**, 710.
76. FEDER, D. D., & COCHRAN, G. A study of individualized instruction at the college level. *Mod. Lang. J.*, 1936, **21**, 23–25.
77. FERGUSON, G. O., JR. Some factors in predicting college success. *Sch. & Soc.*, 1933, **37**, 566–568.
78. FICKEN, C. E. Predicting achievement in the Liberal Arts College. *Sch. & Soc.*, 1935, **42**, 518–520.
79. FINCH, F. C., & NEMZEK, C. L. Prediction of college achievement from data collected during the secondary school period. *J. appl. Psychol.*, 1934, **18**, 454–460.

80. FLEMMING, E. G. College achievement, intelligence, personality, and emotion. *J. appl. Psychol.*, 1932, **16**, 668–674.

*81. FORD, E. G. College success and self-support. *Kentucky Person. Bull.*, 1934, No. 10, 3–4.

82. FRASIER, C. M. The selection of the student teacher. Unpublished Master's Thesis, Colorado State Teachers College, 1928. [Quoted from Whitney & Frasier (**308**).]

83. FREEMAN, H. J., & JONES, L. Final report of the long-term effect of counseling low percentile freshmen. *Sch. & Soc.*, 1933, **38**, 382–384.

84. FRITZ, R. A. Predicting college marks and teaching success for students in a Teachers College. *J. appl. Psychol.*, 1933, **17**, 439–446.

85. GARRETT, H. L. Predicting college success upon the basis of high school records. *Peabody J. Educ.*, 1934, **11**, 193–201.

86. GAUDET, F. J., & MARRYOTT, F. J. Predictive value of the Ferson-Stoddard Law Aptitude Examination. *Amer. Law Sch. Rev.*, 1930, **7**, 27–32.

87. GAUSEWITZ, W. Adapting elementary German to the needs of the gifted student. *Bur. educ. Res. Monogr.*, 1932, No. 15, 135–140.

88. GERBERICH, J. R. A personnel study of 10,000 Iowa high school seniors. *Univ. Ia Stud. Educ.*, 1930, **5**, No. 3.

89. GERBERICH, J. R. Validation of a State-wide educational guidance program for high-school seniors. *Sch. & Soc.*, 1931, **34**, 606–610.

90. GERBERICH, J. R. Five years of experience with a remedial reading course for college students. *J. exp. Educ.*, 1934, **3**, 36–41.

91. GERBERICH, J. R., & JONES, C. The optional and required reading of college students. *Sch. & Soc.*, 1933, **38**, 93–96.

92. GERBERICH, J. R., & WARNER, K. O. Relative instructional efficiencies of the lecture and discussion methods in a university course in American national government. *J. educ. Res.*, 1936, **29**, 574–579.

93. GILBERT, H. N. A comparative study of first year college grades made by graduates of different class high schools. *Educ. Adm. Superv.*, 1932, **18**, 229–232.

94. GILLILAND, A. R. The measurable effect of zoology on psychology grades. *J. educ. Psychol.*, 1935, **26**, 384–387.

95. GILLILAND, A. R., & VOAS, W. H. Personality tests and scholastic attainment. *Person. J.*, 1930, **9**, 305–308.

96. GLATFELTER, M. E. The value of the cooperative English test in prediction for success in college. *Sch. & Soc.*, 1936, **44**, 383–384.

*97. GORDON, M. A. The relation of student load to scholarship and intelligence. *Kentucky Person. Bull.*, 1931, No. 1, 3.

98. GRAY, H. A. Some factors in the undergraduate careers of young college students. *Teach. Coll. Contr. Educ.*, 1930, No. 437.

99. GRAY, W. S. (Ed.) Provision for the individual in college education. *Proc. Inst. Adm. Offcrs higher Instns*, 1932, **4**, 44–54.

100. GROTE, C. Housing and living conditions of women students. New York: Bureau of Publications, Teachers College, Columbia Univ., 1932.

101. HAMMOND, H. P., & STODDARD, G. D. A study of placement examinations. *Univ. Ia Stud. Educ.*, 1928, **4**, No. 7.

102. HARRIMAN, P. L. Auditory acuity and success in college. *Peabody J. Educ.*, 1933, **11**, 25–31.

103. HARRIS, A. J. The relative significance of measures of mechanical aptitude, intelligence, and previous scholarship for predicting achievement in Dental School. *J. appl. Psychol.*, 1937, **21**, 513–521.

104. HARRIS, D. The relation to college grades of some factors other than intelligence. *Arch. Psychol., N. Y.*, 1931, **20**, No. 131.

105. HARTMANN, G. W. Economy of time in college instruction. *J. educ. Res.*, 1931, **23**, 404–409.

106. HARTMANN, G. W. Comparative pupil gains under individual conference and classroom instruction. *J. educ. Psychol.*, 1935, **26**, 367–372.

107. HARTSON, L. D. The validation of the rating scales used with candidates for admission to Oberlin College. *Sch. & Soc.*, 1932, **36**, 413–416.

108. HARTSON, L. D. Further validation of the rating scales used with candidates for admission to Oberlin College. *Sch. & Soc.*, 1937, **46**, 155–160.

109. HAWKS, L. J. Certain relationships between scholarship in high school and in college. *Johns Hopk. Univ. Stud. Educ.*, 1931, No. 15.

110. HELD, O. C. An attempt to predict the success of university freshmen in their adjustment to scholastic work. *Univ. Pittsb. Bull.*, 1931, **28**, 86–94.

111. HERTZBERG, O. I. A comparison of the kindergarten-primary majors with the intermediate and grammar grade majors in a Teachers College. *Sch. & Soc.*, 1933, **37**, 153–154.

112. HOFFMAN, W. S. Predictive selective admissions. *Sch. & Soc.*, 1937, **45**, 829–831.

113. HOLCOMB, G. W., & LASLETT, H. R. A prognostic study of engineering aptitude. *J. appl. Psychol.*, 1932, **16**, 107–116.

114. HOLTZ, H. G., & TRICE, J. A. The relation of an abnormal weekly schedule to grade point average. *Sch. & Soc.*, 1934, **39**, 422–424.

115. HUDELSON, E. Class-size at the college level. Minneapolis: Univ. Minnesota Press, 1928.

116. HURD, A. W. A study of achievement in various engineering and pre-engineering courses. *J. educ. Res.*, 1931, **23**, 25–30.

117. HUSBAND, R. W. Statistical prediction of Law School success. (Abstract.) *Psychol. Bull.*, 1936, **33**, 737–738.

118. JENKINS, J. G. Students' use of time. *Person. J.*, 1931, **10**, 259–264.

119. JOHNSON, E. C., & MORRIS, E. H. Considerations concerning the selection of prospective teachers. *Sch. & Soc.*, 1937, **46**, 222–224.

120. JOHNSON, R. I. The problem of how to study. *Sch. Rev.*, 1937, **45**, 577–584.

121. JOHNSTON, J. B. Advising college students. *J. higher Educ.*, 1930, **1**, 315–320.

122. JOHNSTON, J. B., & WILLIAMSON, E. G. A follow-up study of early scholastic predictions in the University of Minnesota. *Sch. & Soc.*, 1934, **40**, 730–738.

123. JONES, E. S. The grade-test correlation as an index of motivation. *Sch. & Soc.*, 1932, **36**, 478–480.

124. JONES, G. A. A., & LASLETT, H. R. The prediction of scholastic success in college. *J. educ. Res.*, 1935, **29**, 266–271.

125. JONES, L. Class attendance and college marks. *Sch. & Soc.*, 1931, **33**, 444–446.

126. JONES, L. A critical analysis of the personal information blank in use at the State University of Iowa. *Sch. & Soc.*, 1931, **33**, 540–544.

*127. KARRAKER, W. J. The effect of student load on scholarship. *Kentucky Person. Bull.*, 1936, No. 17, 2–3.

*128. KETRON, C. V. A study of a method of orienting college freshmen at the University of Kentucky. *Kentucky Person. Bull.*, 1934, No. 12.

*129. KEYS, N. The under-age student in the large university. *North. Calif. Yearb., Educ. excep. Child*, 1933, **4**, 17–28.

*130. KILBY, M. A study of factors contributing to English scholarship at Asbury College. *Kentucky Person. Bull.*, 1933, No. 7.

131. KOOS, L. V. Private and public secondary education. Chicago: Univ. Chicago Press, 1931.

132. KRIEGER, L. B. M. Prediction of success in professional courses for teachers. *Teach. Coll. Contr. Educ.*, 1930, No. 420.

133. KRINER, H. L. Preliminary report on a five-year study of Teachers College admissions. *Educ. Adm. Superv.*, 1933, **19**, 691–695.

134. KULP, D. H. Weekly tests for graduate students. *Sch. & Soc.*, 1933, **38**, 157–159.

135. KULP, D. H. The role of purpose in achievement. *J. appl. Psychol.*, 1935, **19**, 478–489.

136. LANGLIE, T. A. The Iowa placement examinations at the University of Minnesota. *J. Engng Educ.*, 1927, **17**, 842–860.

137. LANGLIE, T. A. Interests and scholastic proficiency. *Person. J.*, 1930, **9**, 246–250.

138. LARSON, E. L. The comparative quality of work done by students in residence and in correspondence work. *J. educ. Res.*, 1932, **25**, 105–109.

*139. LAUER, A. R. A study of student reading. *Proc. Ia Acad. Sci.*, 1935, **42**, 171–173.

140. LAUER, A. R. An experimental study of the improvement in reading by college students. *J. educ. Psychol.*, 1936, **27**, 655–662.

141. LAUER, A. R., & EVANS, J. E. Note on the influence of a so-called emotional factor on academic success. *J. abnorm. soc. Psychol.*, 1930, **25**, 57–59.

142. LEE, J. M., & SEGEL, D. The utilization of data for simple or direct prediction in the development of differential prediction regression equations. *J. educ. Psychol.*, 1933, **24**, 550–554.

143. LEFEVER, D. W. The prognostic values of certain groupings of the Thorndike Intelligence Examination for High School Graduates. *Univ. S. Calif. Stud. Educ. Ser.*, 1930, No. 9.

144. LEHMAN, H. C. Motivation: college marks and the fraternity pledge. *J. appl. Psychol.*, 1935, **19**, 9–28.

145. LEHMAN, H. C., & STOKE, S. M. Is the heavy schedule an incentive to greater effort? *Sch. & Soc.*, 1930, **32**, 767–771.

146. LESTER, O. P., & BARNETTE, W. L. Some factors relative to adjusted and unadjusted personalities. *J. juv. Res.*, 1932, **16**, 319–325.

147. LIBBY, P. A. A personnel study of Junior College students. Los Angeles: Univ. Southern California Press, 1936.

148. LINCOLN, E. A. The relative standing of pupils in high school, in early college, and in college entrance examinations. *Sch. & Soc.*, 1917, **5**, 417–420.

149. LONGSTAFF, H. P. Analysis of some factors conditioning learning in general psychology. *J. appl. Psychol.*, 1932, **16**, 9–48.

150. LORENZ, A. B., & MCCLURE, W. E. The influence of color blindness on intelligence and achievement of college men. *J. appl. Psychol.*, 1935, **19**, 320–330.

151. LOUTTIT, C. M., & PATRICK, J. R. A study of students' knowledge in the use of the library. *J. appl. Psychol.*, 1932, **16**, 475–484.

152. LUND, F. H. Sex differences in type of educational mastery. *J. educ. Psychol.*, 1932, **23**, 321–330.

153. MACPHAIL, A. H. A comparative study of the quality of academic work done by fraternity and non-fraternity students at Brown University. *Sch. & Soc.*, 1933, **38**, 873–876.

154. MANEY, C. A. Sex-bias in college marking. *J. higher Educ.*, 1933, **4**, 29–31.

155. MANEY, C. A. The grades of college football students. *Sch. & Soc.*, 1933, **38**, 307–308.

156. MANEY, C. A. The distribution of memberships in the extra-curricular activities of the Liberal Arts College. *Sch. & Soc.*, 1934, **39**, 63–64.

157. MANN, C. V. Selecting and guiding engineering students. *Civ. Engng, Easton, Pa.*, 1936, **6**, 581–584.

158. MARBE, K. Die Eignung für die Chirurgie, Orthopadie und Zahnheilkunde. *Dtsch. Z. Chir.*, 1928, **208**, 289–317.

159. MARBE, K. Die Eignung zur Zahnheilkunde und ihre psychotechnische Prufung. *Dtsch. zahnärztl. Wschr.*, 1928, **31**, 233–240.

160. MARSHALL, M. V. The life-career motive and its effect on college work. *J. educ. Res.*, 1936, **29**, 596–598.

161. MCCORMICK, T. C. Rural intelligence and college achievement. *Sociol. soc. Res.*, 1932, **16**, 259–266.

162. MCELHANNON, J. C. The effect of conferences on freshman college grades. *Sch. & Soc.*, 1937, **46**, 94–96.

163. MCGRATH, E. J., & FROMAN, L. A. College aptitude of adult students. *Univ. Buffalo Stud.*, 1936, **14**, 1–34.

164. MCQUITTY, J. V. Relative scholarship of graduates according to accreditation of high schools. *Bull. Amer. Ass. Coll. Registr.*, 1934, **9**, 182–189.

*165. MCQUITTY, J. V. Relative importance of parts of the Iowa English placement test. *Kentucky Person. Bull.*, 1935, No. 13, 4.

166. MEHUS, O. M. Extra-curricular activities and academic achievement. *J. educ. Sociol.*, 1932, **6**, 143–149.

167. MEHUS, O. M. Academic achievement of college students in different kinds of extra-curricular activities. *J. educ. Sociol.*, 1934, **8**, 50–56.

168. MERRIAM, T. A. The relations between scholastic achievement in a school of social work and six factors in students' background. *Teach. Coll. Contr. Educ.*, 1934, No. 616.

169. MESSENGER, H. R. The probability-table, a possible means for early elimination of poor students from Teachers' College. *North. Ill. St. Teach. Coll. Quart.*, May, 1930.

170. MEYER, B. B. M. Remedial instruction for students having difficulty in zoology. *Bur. educ. Res. Monogr.*, 1932, No. 15, 95–108.

171. MILLER, A. J. Is the exceptionally able college student socially maladjusted? *Sch. & Soc.*, 1937, **45**, 862–864.

172. MILLER, D. F. Special treatment of superior students in zoology. *Bur. educ. Res. Monogr.*, 1932, No. 15, 72–78.

173. MILLERS, E. J. A statistical study of the relationship between extra-curricular activities and scholarship. *Athl. J.*, 1927, **7**, 34–44.

174. MOHR, A., & LUND, F. H. Beauty as related to intelligence and educational achievement. *J. soc. Psychol.*, 1933, **4**, 235–239.

175. MOORE, G., & GARRISON, K. C. A comparative study of social and political attitudes of college students. *J. abnorm. soc. Psychol.*, 1932, **29**, 195–208.

176. MOORE, H. Training college freshmen to read. *J. appl. Psychol.*, 1934, **18**, 631–634.

177. MOORE, H. Diagnosing and caring for the reading difficulties of college freshmen. *J. Psychol.*, 1935–1936, **1**, 139–143.

178. MORRIS, E. H. Some results secured in personnel work in a Teachers College. *Sch. & Soc.*, 1934, **39**, 574–576.

179. MOSIER, C. I. Group factors in college curricula. *J. educ. Psychol.*, 1935, **26**, 513–522.

180. MOSIER, C. I. Factors influencing the validity of a scholastic interest scale. *J. educ. Psychol.*, 1937, **28**, 188–196.

181. MOSS, F. A. Aptitude tests in selecting medical students. *Person. J.*, 1931, **10**, 79–94.

*182. MOSS, F. A. Scholastic aptitude tests for medical students. *J. Ass. Amer. med. Coll.*, January, 1933.

183. NEEL, M. O., & MATHEWS, C. O. Needs of superior students. *J. higher Educ.*, 1935, **6**, 29–34.

184. NELSON, M. J. A study in the value of entrance requirements at Iowa State Teachers College. *Sch. & Soc.*, 1933, **37**, 262–264.

185. NELSON, M. J. An experiment with optional attendance. *Sch. & Soc.*, 1937, **45**, 414–416.

186. NOLL, V. H. Laboratory instruction in the field of inorganic chemistry. Minneapolis: Univ. Minnesota Press, 1930.

187. ODELL, C. W. Predicting the scholastic success of college students. *Univ. Ill. Bull.*, 1930, **28**, No. 5. (Bull. No. 52.)

188. ODELL, C. W. The effect of early entrance upon college success. *J. educ. Res.*, 1933, **26**, 510–512.

189. PACE, C. R. Handedness and reading ability in high school and college students. *J. educ. Res.*, 1937, **31**, 205–210.

190. PARR, F. W. Teaching college students how to read. *J. higher Educ.*, 1931, **2**, 324–330.

191. PATRICK, J. R., & ROWLES, E. Intercorrelations among metabolic rate, vital capacity, blood pressure, intelligence, scholarship, personality and other measures on university women. *J. appl. Psychol.*, 1933, **17**, 507–521.

192. PAUL, J. B. Class frequency. *J. higher Educ.*, 1937, **8**, 480–484.

193. PAYNE, A. F., & PERRY, J. D. The intelligence ranking of 250 City College honor students. *Sch. & Soc.*, 1935, **42**, 383–384.

194. PERRY, R. D. Prediction equations for success in college mathematics. *Peabody Coll. Contr. Educ.*, 1934, No. 122.

195. PETTENGILL, T. E. Size of high school and predictive value of class rank and aptitude test rank. *Bull. Amer. Ass. Coll. Registr.*, 1934, **9**, 190–193.

196. PIHLBLAD, C. T., & MCCULLOUGH, E. Some factors in the family background and college records. *Ohio soc. Sci. J.*, 1930, **2**, No. 1, 32–39.

197. PILLSBURY, W. B. Body form and success in studies. *J. soc. Psychol.*, 1938, **7**, 129–139.

198. PINSENT, A. Pre-college teaching experience and other factors in the teaching success of university students. *Brit. J. educ. Psychol.*, 1933, **3**, 109–126; 201–221.

199. POTTER, G. M. Relative efficiency of public and private secondary institutions. *Sch. Rev.*, 1913, **21**, 523–537.

200. POTTHOFF, E. F. Predicting the ultimate failure of college students on the basis of their first quarter's records. *Sch. & Soc.*, 1931, **33**, 203–204.

201. PRESSEY, L. C. A class of probation students. *J. higher Educ.*, 1932, **2**, 506–510.

202. PRESSEY, L. C. Report on an attempt at the prognosis of unusually good and unusually poor scholastic work. *J. educ. Psychol.*, 1932, **23**, 387–389.

203. PRICE, J. W., & MILLER, J. A. An experiment in sectioning students in the second course in zoology. *Bur. educ. Res. Monogr.*, 1932, No. 15, 79–92.

204. RAPHAEL, T. Four years of student mental-hygiene work at the University of Michigan. *Ment. Hyg., N. Y.*, 1936, **20**, 218–231.

205. REED, S. L. Some correlations between mental ability and age and grade for college freshmen. *Proc. Okla. Acad. Sci.*, 1924, **4**, 143–146. (*Univ. Okla. Bull.*, N. S. No. 322.)

206. REEDER, C. W. Forecasting academic success in the College of Commerce and Administration. *Bur. educ. Res. Monogr.*, 1932, No. 15, 206–220.

207. REEDER, C. W. Study habits. *Sch. & Soc.*, 1935, **42**, 413–415.

208. REEVES, F. W., & RUSSELL, J. D. Some university student problems. *Univ. Chicago Surv.*, 1933, **10**, Chap. 7, 121–137.

209. REITZ, W. Forecasting marks of new plan students at the University of Chicago. *Sch. Rev.*, 1935, **43**, 34–48.

210. REMMERS, H. H. Some attributes of superior students. *Person. J.*, 1931, **10**, 167–178.

211. REMMERS, H. H. Experiments in ability grouping in Spanish, German and French. (Abstract.) *Psychol. Bull.*, 1932, **29**, 388–389.

212. REMMERS, H. H. Learning, effort and attitudes as affected by three methods of instruction in elementary psychology. *Bull. Purdue Univ.*, 1933, **33**, No. 6. (*Stud. higher Educ.* XXI.)

213. REMMERS, H. H., HADLEY, L., & LONG, J. K. Learning, effort and attitudes as affected by class size in beginning college engineering mathematics. *Bull. Purdue Univ.*, 1932, **32**, No. 9.

214. REMMERS, H. H., TAYLOR, A. D., & KINTNER, K. E. Student attitudes toward basic freshmen college subjects and their relation to other variables. *Bull. Purdue Univ.*, 1936, **37**, 145–176.

215. RENSSER, W. C., BRINEGAR, V., & FRANK, G. Predicting success in first-year college chemistry. *Sch. & Soc.*, 1934, **40**, 197–200.

216. Report by Advisory Committee on College Testing. The 1932 college sophomore testing program. *Educ. Rec.*, 1932, **13**, 290–343.

217. Report of Committee on Deans' Reports for 1922–23. *Proc. Ass. Coll. sec. Sch. Sth. St.*, 1924, p. 37. [Quoted from Koos (131).]

218. Report of the President and Treasurer of Harvard College, 1926–1927. *Off. Reg. Harv. Univ.*, 1928, **25**, No. 8. [Quoted from Koos (131).]

219. RHINEHART, J. B. An attempt to predict the success of student nurses by the use of a battery of tests. *J. appl. Psychol.*, 1933, **17**, 277–293.

220. RICHARD, BROTHER. The relationship between freshman marks and study environment. *J. educ. Res.*, 1936, **29**, 589–592.

221. RICHARDS, G. Geology—an easier study for boys or for girls? *Science*, 1932, **76**, 434–435.

222. ROBERTS, R. L. The maturation of college students as evidenced by the eight semester average grade points. *Psychol. Monogr.*, 1933, **44**, 263–281.

223. ROBINSON, F. P. Can college freshmen in the lowest tenth in reading be aided scholastically? *Sch. & Soc.*, 1931, **34**, 843–846.

224. ROE, A. M., & BROWN, C. F. Qualifications for dentistry: a preliminary study. *Person. J.*, 1927, **6**, 176–181.

225. ROGERS, H. W. Science in secondary school and college. *Sch. & Soc.*, 1934, **40**, 334–336.

226. ROGERS, H. W. The reliability of college grades. *Sch. & Soc.*, 1937, **45**, 758–760.

227. ROOT, A. R. College achievement. *J. higher Educ.*, 1936, **7**, 387–388.

228. ROSS, C. C., & KLISE, N. M. Study methods of college students in relation to intelligence and achievement. *Educ. Adm. Superv.*, 1927, **13**, 551–562.

229. ROSS, F. C. A method of forecasting college success. *Sch. & Soc.*, 1931, **34**, 20–22.

230. RUMMELL, H. S. Scholastic ranking of religious groups. *Sch. & Soc.*, 1934, **40**, 286–288.

231. RYAN, G. An experiment in class instruction versus independent study at college level. Baltimore: Author, 1932.

232. SARBAUGH, M. E. The effect of repetition of high school courses on college success. *Univ. Buffalo Stud.*, 1934, **9**, 174–183.

233. SARBAUGH, M. E. The young college student. *Univ. Buffalo Stud.*, 1934, **9**, 58–73.

234. SCHLEIER, L. M., & SCHREIBER, E. W. The freshmen testing program. *West. Ill. St. Teach. Coll. Quart.*, 1932, **12**, No. 3.

235. SCHMITZ, S. B. Predicting success in college: a study of various criteria. *J. educ. Psychol.*, 1937, **28**, 465–473.

236. SCHORN, M. Untersuchungen über die Handgeschicklichkeit. *Z. Psychol.*, 1929, **112**, 325–378.

237. SCHULTZ, R. S. The relation of general intelligence, motor adaptability, and motor learning to success in dental technical courses. *Psychol. Clin.*, 1932–1933, **21**, 226–234.

238. SEGEL, D. Differential prediction of ability as represented by college subject groups. *J. educ. Res.*, 1932, **25**, 14–26; 93–98.

239. SEGEL, D. Differential prediction of scholarship success. *Sch. & Soc.*, 1934, **39**, 91–96.

240. SEGEL, D. Prediction of success in college. *U. S. Off. Educ. Bull.*, 1934, No. 15.

241. SEGEL, D., & GERBERICH, J. R. Differential college achievement predicted by the American Council psychological examination. *J. appl. Psychol.*, 1933, **17**, 637–645.

242. SELOVER, R. B., & PORTER, J. B. Prediction of the scholarship of freshman men by tests of listening and learning ability. *J. appl. Psychol.*, 1937, **21**, 583–588.

243. SHIPLEY, G. T. An evaluation of guided study and small group discussion in a Normal School. *Teach. Coll. Contr. Educ.*, 1932, No. 486.

244. SHIRLEY, M., & HEVNER, K. An experiment in teaching laboratory psychology by the project method. *J. appl. Psychol.*, 1930, **14**, 309–354.

245. SHOFSTALL, W. P. Foreign language requirements for pre-professional study. *Bull. Amer. Ass. Coll. Registr.*, 1936, **12**, 11–14.

246. SMITH, M. E., & DOUGLASS, H. R. The relation of high-school Latin to marks in the first year of Arts College. *Sch. Rev.*, 1937, **45**, 695–701.

247. SMITH, M. R. Student aid. *Teach. Coll. Contr. Educ.*, 1937, No. 704.

248. STAGNER, R. The relation of personality to academic aptitude and achievement. *J. educ. Res.*, 1933, **26**, 648–660.

249. STALNAKER, J. M. A statistical study of some aspects of the Purdue orientation testing program. *Bull. Purdue Univ.*, 1928, **28**, No. 6. (*Stud. higher Educ.* VIII.)

250. STALNAKER, J. M. An investigation of the success of the Indiana high school graduates in Indiana higher institutions of education. *Sch. & Soc.*, 1930, **32**, 813–816.

251. STALNAKER, J. M. The relationship between the examination load and grades at the University of Chicago. *Sch. & Soc.*, 1936, **43**, 134–136.

252. STALNAKER, J. M., & WOELLNER, R. C. Ability of employed students. *J. higher Educ.*, 1936, **7**, 159–160.

253. STARBUCK, A. The freshman's first hurdle. *Engl. J.* (Coll. ed.), 1933, **22**, 643–649.

254. STARRAK, J. A. Matching ability with achievement. *J. higher Educ.*, 1937, **8**, 315–320.

255. STODDARD, G. D. Iowa placement examinations. *Univ. Ia Stud. Educ.*, 1925, **3**, No. 2.

256. STODDARD, G. D. Iowa placement examinations. *Sch. & Soc.*, 1926, **24**, 212–216.

257. STOKE, S. M., & LEHMAN, H. C. The influence of self-interest upon questionnaire replies. *Sch. & Soc.*, 1930, **32**, 435–438.

258. STRABEL, E. What about warned students? *Sch. & Soc.*, 1935, **42**, 581–584.

259. STRABEL, E. The post-graduate high school student. *Bull. Amer. Ass. Coll. Registr.*, 1936, **12**, 1–10.

260. STRABEL, E. The accelerated high school graduate. *Univ. Buffalo Stud.*, 1936, **13**, 79–99.

261. STRABEL, E. Post-graduates and those out of school between high school and college. *Univ. Buffalo Stud.*, 1936, **13**, 101–112.

262. STRABEL, E. A comparison of the various atypically aged groups. *Univ. Buffalo Stud.*, 1936, **13**, 113–123.

263. TAYLOR, H. R. The scholastic significance of certain personality traits. (Abstract.) *Psychol. Bull.*, 1933, **30**, 600.

264. TAYLOR, L. The ready-made drawing with relation to student achievement. *Sch. & Soc.*, 1930, **32**, 371–374.

265. TERRY, P. W. The prognostic value of different types of tests in courses in educational psychology. *J. appl. Psychol.*, 1934, **18**, 231–240.

266. THOMPSON, L. A. Personal history, intelligence and academic achievement. *J. soc. Psychol.*, 1934, **5**, 500–507.

267. THOMPSON, W. H. Experiment in remedial reading. *Sch. & Soc.*, 1931, **34**, 156–158.

268. THURBER, C. H. Is scholarship ranking useful for prediction? *Sch. & Soc.*, 1933, **37**, 327–329.

269. TILSON, L. M. A study of the predictive value of music talent tests for teacher-training purposes. *Teach. Coll. J. Ind.*, 1931, **3**, 101–129.

270. TILSON, L. M. The music achievement of college students at various levels of music talent and psychological rating. *Teach. Coll. J. Ind.*, 1935, **6**, No. 5, 169–176.

271. TOUTON, F. C. Scholastic aptitudes and achievements of FERA students. *Sch. & Soc.*, 1935, **42**, 269–271.

272. TURNBULL, G. H. The influence of previous teaching experience on results obtained by students in a university department of education. *Brit. J. educ. Psychol.*, 1934, **4**, 1–10.

273. TURNEY, A. H. The effect of frequent short objective tests. *Sch. & Soc.*, 1931, **33**, 760–762.

274. TURRELL, A. M. Relationship of personality to scholarship. *Jr Coll. J.*, 1935, **5**, 355–357.

275. TURRELL, A. M. Study methods and scholarship improvement. *Jr Coll. J.*, 1937, **7**, 295–301.

276. TYLER, H. T. The bearing of certain personality factors other than intelligence on academic success. *Teach. Coll. Contr. Educ.*, 1931, No. 468.

277. UHRBROCK, R. S. The freshman's use of time. *J. higher Educ.*, 1931, **2**, 137–143.

278. UMSTATTD, J. G. Student self-support at the University of Minnesota. Minneapolis: Univ. Minnesota Press, 1932.

279. UPSHALL, C. C., & MASTERS, H. V. An evaluation of certain tests and information for predicting success in Normal School. *Res. higher Educ. Bull.*, 1931, No. 12, 21–32.

280. VAN TUYL, K., & EURICH, A. C. Measuring the interests of college students with different major subjects. *J. appl. Psychol.*, 1934, **18**, 27–44.

281. VER STEEG, K. Is geology easier for boys than for girls? *Science*, 1933, **77**, 169.

282. VIRGIL, SISTER. Prognosis in German. *Mod. Lang. J.*, 1936, **20**, 275–287.

283. WAGNER, M. E. Prediction of college success. *Univ. Buffalo Stud.*, 1934, **9**, 125–144.

284. WAGNER, M. E. Prediction of specific college field and course performance. *Univ. Buffalo Stud.*, 1934, **9**, 145–173.

285. WAGNER, M. E. Regents grades as a cumulative educational record. *Sch. & Soc.*, 1934, **40**, 367–368.

286. WAGNER, M. E., EIDUSON, H. P., & MORRIS, R. J. R. The effect of Federal Emergency Relief Administration employment upon college grades. *Sch. & Soc.*, 1937, **45**, 24–26.

287. WAGNER, M. E., & STRABEL, E. Homogeneous grouping as a technique for improving prediction coefficients. *Sch. & Soc.*, 1934, **40**, 887–888.

288. WAGNER, M. E., & STRABEL, E. Predicting success in the college physical sciences. *Sci. Educ.*, 1935, **19**, 4–9.

289. WAGNER, M. E., & STRABEL, E. Predicting success and failure in college ancient and modern foreign languages. *Mod. Lang. J.*, 1935, **19**, 285–293.

290. WAGNER, M. E., & STRABEL, E. Predicting performance in college English. *J. educ. Res.*, 1937, **30**, 694–699.

291. WAITS, J. V. The differential predictive value of the psychological examination of the American Council on Education. *J. exp. Educ.*, 1933, **1**, 264–271.

292. WAKEHAM, G. High-school and college chemistry. *Sch. & Soc.*, 1930, **32**, 206–208.

293. WAKEHAM, G. High-school subjects and general college chemistry. *Sch. & Soc.*, 1935, **41**, 739–740.

294. WALKER, E. T. Student housing and university success. *Sch. & Soc.*, 1935, **42**, 575–577.

295. WALTERS, A., & EURICH, A. C. A quantitative study of the major interests of college students. *J. educ. Psychol.*, 1936, **27**, 561–571.

296. WALTERS, J. E. Seniors as counselors. *J. higher Educ.*, 1931, **2**, 446–448.

297. WALTERS, J. E. Measuring effectiveness of personnel counseling. *Person. J.*, 1932, **11**, 227–236.

298. WATSON, G. H. Success and failure in the teaching profession. An exploration of some areas of difference between students for whom predictions of outstanding success or failure are made. New York: Teachers College, Columbia Univ., 1932.

*299. WATSON, W. E. Predicting first semester scholarship. *Kentucky Person. Bull.*, 1934, No. 10.

300. WEINLAND, J. D. How successful college students study. *J. educ. Psychol.*, 1930, **21**, 521–526.

301. WEST, L. S., & MCKEOWN, E. Performance of college students interpreted in the light of pedigree records. *Eugen. News*, 1933, **18**, 60–66.

302. WHELDEN, C. H. Training in Latin and the quality of other academic work. *J. educ. Psychol.*, 1933, **24**, 481–497.

303. WHIPPLE, G. M. Diagnosing operative skill in dentistry. *Person. J.*, 1928, **7**, 150.

304. WHITE, H. D. J. An application of mental tests to university students. *Brit. J. educ. Psychol.*, 1931, **1**, 279–295; 1932, **2**, 53–70.

305. WHITMAN, A. D. Value of the examinations of the College Entrance Examination Board as predictions of success in college. New York: Teachers College, Columbia Univ., 1926. (Lincoln School Publication No. 48.)

306. WHITMER, C. A. A study of the scholastic progress of college probationers. *J. appl. Psychol.*, 1933, **17**, 39–49.

307. WHITNEY, F. L. The prediction of teaching success. *J. educ. Res. Monogr.*, 1924, No. 6.

308. WHITNEY, F. L., & FRASIER, C. M. The relation of intelligence to student teaching success. *Peabody J. Educ.*, 1930, **8**, 3–6.

309. WILLIAMS, R. L. Language elections made by freshmen of the University of Michigan. *Sch. & Soc.*, 1937, **46**, 477–480.

310. WILLIAMSON, E. G. An analysis of scholastic aptitude of freshmen, in some private colleges in Minnesota. *Sch. & Soc.*, 1931, **34**, 674–680.

311. WILLIAMSON, E. G. The relationship of number of hours of study to scholarship. *J. educ. Psychol.*, 1935, **26**, 682–688.

312. WILLIAMSON, E. G. The role of faculty counseling in scholastic motivation. *J. appl. Psychol.*, 1936, **20**, 314–324.

313. WILLIAMSON, E. G. The decreasing accuracy of scholastic predictions. *J. educ. Psychol.*, 1937, **28**, 1–16.

314. WILLIAMSON, E. G. An analysis of the Young-Estabrooks studiousness scale. *J. appl. Psychol.*, 1937, **21**, 260–264.

315. WILLIAMSON, E. G. Scholastic motivation and the choice of a vocation. *Sch. & Soc.*, 1937, **46**, 353–357.

316. WILLIAMSON, E. G., & DARLEY, J. G. Student personnel work: an outline of clinical procedures. New York: McGraw-Hill, 1937.

317. WILSON, M. O., & HODGES, J. H. Predicting success in the Engineering College. *J. appl. Psychol.*, 1932, **16**, 343–357.

318. WINTER, J. E. An experimental study of the effect on learning of supervised and unsupervised study among college freshmen. *J. educ. Psychol.*, 1936, **27**, 111–118.

319. WORCESTER, D. A. Purpose and college attendance. *J. higher Educ.*, 1931, **2**, 190–194.

*320. WRENN, C. G. Study habits inventory. Stanford Univ.: Stanford Univ. Press, 1933.

321. WRENN, C. G. Aiding the fit. *J. higher Educ.*, 1935, **6**, 357–363.

*322. YATES, L. Grading students in sections of freshman English. *Kentucky Person. Bull.*, 1934, No. 12.

323. YOUNG, C. W. Scholarship and social adjustment. *Sch. & Soc.*, 1936, **43**, 607–608.

324. YOUNG, C. W., & ESTABROOKS, G. H. Non-intellective factors related to scholastic achievement. (Abstract.) *Psychol. Bull.*, 1934, **31**, 735–736.

*325. YOUNG, C. W., & ESTABROOKS, G. H. Young-Estabrooks scale for measuring studiousness by means of the Strong Vocational Interest Blank for Men. Stanford Univ.: Stanford Univ. Press, 1936.

326. YOUNG, C. W., & ESTABROOKS, G. H. Report of the Young-Estabrooks studiousness scale for use with the Strong Vocational Interest Blank for Men. *J. educ. Psychol.*, 1937, **28**, 176–187.

327. YOUNG, K., DOURGHT, N., & BERGSTRESSER, J. Social and emotional adjustments of freshmen at the University of Wisconsin. *Amer. sociol. Rev.*, 1937, **2**, 166–177.

328. ZORBAUGH, G. S. M., & KUDER, G. F. College grades and the vocational motive. *Sch. & Soc.*, 1937, **46**, 62–64.

"CONSTANCY" OF THE IQ

BY ROBERT L. THORNDIKE
Teachers College, Columbia University

It is the purpose of this article to review recent experimental evidence on the stability of intelligence test performance by the same individual over a lapse of time. The content of the review will be limited in two ways:

(1) It is proposed to consider chiefly those reports which have appeared since 1930 or 1931. The literature previous to that time has been covered by Nemzek (75), Foran (24, 25), and others. Earlier studies will be referred to only as this becomes necessary to understand recent trends of investigation.

(2) It is proposed to limit this report primarily to those investigations in which the same individuals have been tested more than once. Although studies of the resemblance of relatives, the intelligence level of occupational groups, etc. provide evidence concerning the relative weight of hereditary, as opposed to environmental, factors in producing differences in intelligence test performance, and consequently bear on the stability of the performance of the individual, it is not our purpose to try to cover this broader literature here.

Certain general trends seem to appear in the type of experimentation reported within the last eight years, and it might be profitable to consider these briefly before going on to a survey of findings. In the period now being studied, the general fact of a rather high positive correlation between test and retest after an interval of time in children of school age seems to be fairly well taken for granted, and relatively few studies were found which were concerned merely with demonstrating this point. Most studies try to push this finding forward in one or another of several directions, of which the following are rather typical: (a) attempts to get retest information on younger and younger children; (b) efforts to get retest data over longer periods of time; (c) efforts to determine the effect upon test constancy of particular types of environmental manipulation.

General Studies of Test-Retest Correlation in Adults

Several studies of college students at the beginning and end of their college course have been carried out, primarily with the purpose

of studying gains during the years at college. These studies have agreed in finding that those students who remain through a college course tend to gain in intelligence test score. Test-retest correlations are also reported. Between scores on the Thorndike Intelligence Examination for High School Graduates, Part I, before and after a two-year course at normal school Masters and Upshall (**63**) report correlations of .78 and .80 for two groups. Wolcott (**111**) finds a correlation of .81 between scores as freshmen and as seniors on the Thorndike examination. McConnell (**66**) reports a correlation of .83 between freshman and senior scores on the American Council examination. For this same test, given before and after a four-year interval of college, Livesay (**55**) reports a correlation of .88 for total score and correlations of .69 to .82 for individual subtests.

Testing reformatory inmates with an average age of about 20 years on the Kuhlmann-Anderson test, Hales (**32**) reports a correlation of .89 when the average interval between test and retest is about five years.

Two studies have been made of small groups of adults over a 10-year interval. Davidson (**17**) reports a correlation of .89 for a group of 50 insurance company employees tested with a brief group intelligence test. Garrison (**28**) retested a group of students, whose average age at time of first testing was 25 years, with the Yerkes point scale, using a revised scoring. The correlations were .58 for a group of 32 men and .76 for a group of 41 women.

In view of the limitations placed by the reliability of the tests used and the limited range to be expected in some of the groups, these studies offer confirming evidence of the stability of intelligence test performance in adults in fairly stable surroundings, even over quite a period of years.

Studies of School-Age Children

In the decade of the twenties, reports of correlations and mean differences between intelligence tests and retests given after various lapses of time were quite numerous for general school-age populations. In the thirties, however, relatively few such studies have appeared. Studies of too recent a date to be included in Nemzek's review (**75**) are reported below.

Lauderbach and Hause (**47**). McCall multi-mental test given to 150 students in Grades 4 to 6. Retested after an interval of 11 months. Test-retest correlation of .791.

Lincoln and Wadleigh (**53**). Otis Primary, National A, and

Terman A given in successive years at approximately one-year intervals. The 154 children tested were in Grade 3 at the time of the first test. The median of all the differences in IQ was reported as 7.29 points. Thirty-seven per cent of the changes were 10 points or more.

Miller (**69**). The data reported by Hirsch (**37**) were reanalyzed, using only those cases who took all tests and converting the scores on successive tests into scores with the same mean and standard deviation. The median difference was found to increase progressively from 5.4 IQ points at a one-year interval to 7.3 points at a five-year interval. The corresponding correlation dropped from approximately .85 to .79.

Lithauer and Klineberg (**54**). The test-retest correlation for the Stanford-Binet for 120 orphans first tested shortly after entrance to the Hebrew Orphan Asylum, and retested after a median interval of 14 months, is reported to be .76.

Traxler (**102**). Otis Self-Administering IQ's were obtained for students at the University of Chicago High School. Retests were obtained after intervals of one, two, and three years. Correlations were .756, .673, and .676, respectively. For the same students, the retest correlation for the Binet with an interval of one to four years is reported to be .762.

Seagoe (**87**). Tests were given to school children in Grades 1, 3, 5, and 7. Tests were Detroit First-Grade, Detroit Primary, National Intelligence, and Terman Group, respectively. Retests were available for those children who remained in the system long enough to be caught by two or more tests. Successive tests were at two-year intervals. Correlations were reported as follows: Detroit First-Grade *vs.* Detroit Primary, .642; Detroit Primary *vs.* N.I.T., .700 and .727; N.I.T. *vs.* Terman Group, .797 and .869. Over a four-year interval, Detroit Primary correlated with Terman Group .765.

Lorge (**57**). About 160 boys, a random sample of 860 who had been tested in the eighth grade, were retested after an interval of a little over 10 years. Both raw correlations and correlations corrected for estimated test unreliability were presented. These were:

	Raw	Corrected
Thorndike-McCall Reading Scale	.57	.74
I.E.R. Arithmetic Test	.60	.79
Stenquist Assembly Test	.66	1.06
I.E.R. General Clerical Test	.63	.75

The results of these studies fit in quite well with the general trend of earlier investigations, and the size of the correlations reported here

is comparable to the average for the Stanford-Binet and for group tests reported in Nemzek's summary (75).

The somewhat lower correlations reported in the study by Lorge (57) direct attention to the factor of interval between test and retest as one factor influencing the stability of performance from test to retest. This has been considered by R. L. Thorndike (101) in a synthesis of previous studies. Putting together the data from those studies in which the interval between test and retest was fairly uniform, a curve was fitted to all the data by the method of least squares. The correlation for an immediate retest, estimated from this curve, falls close to .90, and the correlation for a test after a five-year interval is estimated to be about .70. Further data on the question of time interval is contributed by the study of R. R. Brown (8). In one comparison of 58 cases who had a first retest after an interval of less than two years and a second retest after an interval of five years or more, he found the correlation between initial test and first retest to be .86 and between initial test and second retest to be .61. It seems apparent that one factor which influences the accuracy of prediction from an intelligence test at school age is the length of time over which we endeavor to predict.

Studies of Gifted Children First Tested at School Age

The performance upon adult tests at maturity of gifted children first tested while in school has been studied by Hollingworth and Kaunitz (39) and by Lorge and Hollingworth (58). In the first of these studies, 116 children who had received Binet IQ's of 135 or higher when they were about eight years old were tested with the Army Alpha approximately 10 years later. Of these children, who had been chosen to represent the top centile of the child population, 82% scored in the top centile on the Army Alpha according to the Army norms. The remainder were in the high centiles. No individual regressed to, or nearly to, average. Lorge and Hollingworth report additional test material on a group of 21 individuals who, as children, had a median IQ of 168. On the CAVD intelligence test, 20 of the 21 were found to surpass the median of law school freshmen. Those who had, as children, received IQ's of about 140 were found to define approximately the seventy-fifth percentile of college graduates, taking it the country over.

Whether the IQ's of gifted children tend to increase or decrease has been studied by Lincoln (49, 50, 51, 52) and by Cattell (10).

Lincoln finds that, when children are classed on the basis of their initial test, those with high initial tests tend to decline. Cattell finds that, when children are classified on the basis of the average of their initial and final tests, children in the highest classifications tend to have higher final tests than initial tests. These results are in no sense contradictory, the first illustrating the universal tendency of any fallible measure to regress toward the mean of the sample upon repetition, and the second being evidence of a tendency for the variability of IQ's in the population to increase with increasing age.

Nemzek (73, 74) analyzed data previously reported by Carroll and Hollingworth and by Lamson, and found correlations between Stanford-Binet test and retest with an interval of one or two years of .53 to .72. For data on the Herring-Binet the correlation was .73. For the Stanford-Binet the mean change ranged from 7.85 to 9.37 points, and for the Herring-Binet it was 9.06 points. Nemzek concluded that the IQ was more variable for gifted children, which is in accord with other results on this question. McNemar (67) has pointed out that the greater variability of high IQ's is inherent in the use of a ratio and appears as an inevitable consequence if the variability in performance at a given mental age level is constant.

Retarded or Otherwise Handicapped Groups

Studies of the mentally retarded by Arthur (2), Engel (21), Hoakley (38), Parker (77, 78), and Woodall (112) confirm, in general, previous findings of a progressive decline in the IQ's of these groups. Woodall finds an increase in IQ for retarded individuals after the age of 16, indicating that mental growth has not completely stopped at that age. The greater stability of the IQ for defective groups again becomes apparent in these studies. As mentioned above, it must be remembered that this is implicit in the use of such a ratio as the IQ.

Schott (84) reports that adult neuropsychiatric cases show markedly greater variation between tests than do normal children.

Miller (68) suggests that a pseudointellectual deficiency may be produced by emotional maladjustment, and that this is remediable with careful treatment.

Arthur (3) finds that "an examination with the Kuhlmann-Binet given by an experienced psychologist to a kindergarten, first, or second grade child from a non-English-speaking home can yield a rating with a high degree of reliability and predictive value as measured by achievement on the Kuhlmann-Anderson 5 to 7 years later,

if the child has had as much as a year in the English-speaking school environment."

Gildea and Macoubrey (30) and O'Neill (76) have endeavored to analyze the factors associated with large changes in IQ between test and retest. Lack of a control group in one study, and limited statistical analysis in both, preclude any definite conclusions. The pattern of factors involved seems to be quite complex in any event.

Predictive Value of Infant and Preschool Tests

Following upon the success of the intelligence tests for school-age children, efforts have been made to develop tests for younger and younger children. The years covered by this review have witnessed a growing crop of studies of the constancy and predictive value of indices derived from these early tests. Evidence on the predictive value of tests at these early years has been presented by Bayley (6), Cunningham (15), Driscoll (19), Furfey and Muehlenbein (27), Gesell and others (29), Hallowell (33), Herring (35), Honzik (40), Hubbard (41), Kawin (43), Mowrer (70), Nelson and Richards (71, 72), Stutsman (98), Symmes (99), Updegraff (103), and Wellman (105, 106, 107). These studies cover a number of different tests and differ quite a bit in the age and other characteristics of the population studied. Consequently, any effort to lump the studies together and generalize from them may well be questioned. However, we have tried to do this in a rough sort of way. Taking the test-retest correlations from those studies in which they were available, and in which the tests had been given at fairly definitely specified ages, it was possible to tabulate them according to age at first test and interval between test and retest. This has been done with correlations from the studies by Bayley (6), Cunningham (15), Driscoll (19), Furfey and Muehlenbein (27), Herring (35), Honzik (40), Kawin (43), and Nelson and Richards (71, 72), and from the earlier study by Goodenough (31). A table was prepared, and each correlation coefficient was entered in the appropriate cell. The average correlation coefficient in each cell was then determined, as a rough estimate of the degree to which it is possible to predict over that interval at that age. These average coefficients are presented in Table I.

In any interpretation of Table I the diversity of tests studied,

the diversity of final tests being predicted, and variations in the range of ability in the groups being studied must be borne in mind. Furthermore, no effort was made to apply differential weights, taking into account the different sizes of populations studied, to the correlations upon which Table I is based. Finally, some of the figures reported in Table I are based upon only one correlation or the work of only one experimenter, while others are based upon a number. However, it seems clear from these results that the adequacy of prediction of future mental development is a combined function of the age at which the test is given and of the length of time over which

TABLE I

COMPOSITE OF TEST-RETEST CORRELATIONS FROM SEVERAL STUDIES OF INFANT AND PRESCHOOL GROUPS

Age at Earlier Test	Interval Between Test and Retest							
	Less than 4 mos.	4–9 mos.	10–15 mos.	16–21 mos.	22–29 mos.	30–41 mos.	42–53 mos.	Over 53 mos.
Under 4 mos.	.57	.33	.10	—.03	—.09			
4–9 mos.	.77	.53	.49	.23	.16	.46	.00	
10–15 mos.	.78	.66	.50	.45	.33			.55
16–21 mos.	.76	.68	.51	.44	.38	.41	.25	.33
22–29 mos.	.82	.74	.68					.43
30–41 mos.	.87	.68	.66	.49	.57	.57	.56	.66
42–53 mos.	.81	.65	.72	.71	.66	.63	.63	.41
54–65 mos.			.76		.73			

we try to predict. Before the age of four months, it seems impossible to get satisfactory correlations between tests given no more than a month apart. From this point on, however, correlations of .75 and better seem to be obtainable for such short-time forecasting. But it is not until the individual is about four years old that predictions can be made over a span of as long as a year with a correlation of .70 or better. It does not seem possible to make very reliable *long-time* predictions from any of these early tests.

Honzik (40), working with tests between the ages of 21 and 84 months, suggested that the size of correlation might be thought of as a linear function of age at the time of the first test divided by age at the time of the second test. She found a correlation of .92 for one group and a correlation of .78 for another between this ratio and the correlation coefficient between test and retest. Apparently, within the range of ages and intervals that she studied, the relation did hold in an approximate sort of way. Whether it would hold as well over a greater range of ages is, of course, open to question. English and

Killian (22) present some evidence to suggest that age is not a factor in determining the amount of variation between tests between the ages of 4 and 16.

At least two alternative explanations of the limited value of these early tests in predicting school-age intelligence test performance may be suggested. On the one hand, it may be argued that at this early age the individual is very susceptible to environmental influences, and so his intellectual development is likely to be markedly accelerated or retarded, depending upon the environment to which he is exposed. Low correlations between early and late tests would be thought of as due to the differential effect of different environments. On the other hand, it may be suggested that the aspects of mental functioning studied by early tests are rather different from those incorporated in school-age tests. This seems at least superficially true, as we consider the test materials. It may be that in the early tests we are not testing quite the same type or aspect of "intelligence" that we test in school children, possibly because the type of function which we study in our later tests is not as yet present or susceptible to testing. The low correlations would, in this case, be explained as due to a considerable shift in the aspect of intellectual functioning which we were testing.

Effect Upon Intelligence of Change in Physical Environment

Studies of the effect of diet upon learning and intelligence are reviewed by Fritz (26), who concludes that "contrary to what would be generally supposed, there is very little experimental evidence at present to indicate that diet markedly affects intelligence or capacity to learn." Fritz indicates that the results of Maurer and Tsai, showing the effect of vitamin B deficiency upon maze learning in rats, represent an exception to this generalization.

Balken and Maurer (5) report a preliminary study of the effect of increasing the vitamin B intake of malnourished children. A variety of mental tests were given to 46 children from homes of very low economic status in which vitamin B deficiency was probable. The children were given supplementary feedings of vitamin B for 15 weeks, and tests were repeated at the end of this time. Gains were found upon each test, but these were generally small. No control group was used, so it is impossible to determine whether there would have been any residual gain after practice effects had been eliminated.

Poull (80) matched 41 pairs of records from the testing at New

York City Children's Hospital. One member of each pair was originally malnourished, as judged by the physician's statement, and subsequently became well nourished. The control group was uniformly well nourished. The group whose nutritional status improved showed an average gain in IQ of approximately 10 points, while the control group showed no change.

Studies of the effect of diseased tonsils and adenoids by Richey (**81**) and of intestinal protozoa by Schell (**83**) gave negative results.

Mateer (**64**) finds evidence that gains may result from a combination of glandular and educational treatment in hypopituitary cases.

Dawson (**18**) reports small, but reliable, gains in IQ for a group removed from a slum to a housing project.

Effect of Changed Social or Educational Environment

We must next consider various investigations which introduce certain special factors into the social or educational life of the child. Familiar patterns, occurring during the period covered by this survey, are (1) placement in a foster home, (2) placement in some sort of institution, (3) experience in a nursery school, (4) exposure to some special type of schooling in the regular grades, either in the general character of the school or through some special type of instruction.

To the earlier foster-child studies there have been added during this period studies by Hinton (**36**), Leahy (**48**), Lithauer and Klineberg (**54**), Schott (**85**), Skodak (**95, 96**) [the report by Skodak is taken as most completely representing the Iowa investigation, parts of which have also been reported by Skeels (**90, 91, 92**)], and Wells and Arthur (**109**). The last four of these authors report average changes from before placement in a foster home to some time after placement. The studies by Lithauer and Klineberg, Schott, and Skodak agree in finding an average rise of about six points in IQ for retests given within a year or two of placement. In the Skodak study there was some indication of further gain upon a subsequent retest.

The study by Skodak centered its attention upon the intelligence of a group of children (mostly known to be illegitimate) who were placed in foster homes before the age of six months. Each of these children received two tests, the first at an average age of two years, seven months, and the second at an average age of four years, four months. The average IQ was 116.0 at the time of the first test and

111.5 at the time of the second test. The correlation between these two tests, with an average interval of 21 months, is reported as .56. This corresponds quite closely to correlations reported in other studies for this age and interval, as summarized in our Table I.

The average level of IQ at the time of the second test is in close agreement with results reported by Leahy (**48**) for somewhat older foster illegitimate children. Leahy reports a mean IQ of 110. What judgment we shall make as to the contribution of the improved foster environment to this average IQ depends upon a judgment as to the IQ expectancy from the true parents. For some of her cases Skodak presents data on true-father's occupation, true-parent's education, and true-mother's Binet IQ. Occupationally, the group is clearly low, though just what that means for intelligence in these times is not as clear as it would have been a decade or more ago. The mean mid-parent education is 10 grades, which seems fairly substantial. The mean IQ of mother is reported as 88.7. This, however, is derived from the Stanford-Binet, with 16 years as the divisor, and is established for a group of unspecified age, tested at an unspecified interval after their school experience. An assumption that the genetic expectancy of the foster group was below 100 IQ seems to be open to question—especially as the preplacement IQ's of the group of children tested before and after placement (mentioned earlier), who represented a poorer sample educationally and occupationally, had an average of 98.5.

The relationship of foster-child intelligence to characteristics of the true and foster parents is somewhat vitiated in this study by selective placement. There was a correlation of .30 between mid-parent education for true and foster parent. This indication of selection makes any interpretation of relationship of child intelligence to either characteristics of true parents or characteristics of foster parents somewhat hazardous.

Wells and Arthur (**109**) studied children one or both of whose parents were classed as feebleminded. They compared the course of intellectual development for children left in their own homes with that of children placed in certified foster homes. Over a period of about five years the differential between these two groups amounted to about eight IQ points in favor of those in foster homes. For a rather small group, first tested before the age of five years, the differential was approximately 16 points.

Rather in contrast with the other findings, Hinton (**36**) reports that children transferred to Mooseheart, which is judged to present a

social environment greatly superior to the one these children had previously known, show no reliable change in IQ over a period of five years subsequent to entrance. However, the younger children are reported to gain more than the older ones.

Change in IQ during residence in an orphanage or during residence in an institution for the feebleminded was studied by Crissey (**13, 14**). The finding which is emphasized in this study, as in a number of the other studies from the University of Iowa, is that the extreme members of the group tend to move toward the average of the group upon repeated tests. There does not seem to be sufficient appreciation, however, of the significance of errors of measurement in producing this change. It must be borne in mind, as one reads any of these studies, that those members of any group who are at the top of the group in score on a fallible measure, whether the scores be high or low in terms of some more extensive total population, fall at the top of the group, in part because of a preponderance of plus errors of measurement, and will tend, in the absence of other influences, to drop back toward the mean of the group in any test that is not perfectly correlated with the first test. The converse is, of course, true of those at the bottom.

Crissey also finds a suggestion that those who would be expected to have constant IQ's in an orphanage tend to show a drop when transferred to the home for feebleminded, and that those who would be expected to drop in the home for feebleminded fail to do so when transferred to the orphanage. This is interpreted as being due to the difference in stimulation value of the two environments. One must bear in mind, however, the possibility that other factors, which were a symptom of a dropping IQ, caused the transfer to the asylum, or that other behavior, indicating intelligence superior to that demonstrated on the test, may have been a factor in transferring children from the asylum to the orphanage.

A number of studies have brought out the retarding effect of an impoverished environment by comparing IQ's of younger and older children in the same family or district. During the period of this review, studies based upon such data were reported by Asher (**4**), Ludeman and McAnelly (**60**), Sherman and Key (**88**), Skeels and Fillmore (**93**), and Wheeler (**110**). Since they fall somewhat outside the focus of interest of this review, no further mention will be made of them.

To the earlier studies of the effect of nursery school training, the period here being reviewed sees the addition of the series of reports

by Wellman and others (12, 105, 106, 107, 108) of children in the University of Iowa preschool, the study by Skeels, Updegraff, Wellman, and Williams (94) of a nursery school project in an Iowa orphanage, and the report by Kawin and Hoefer (44) of a nursery school project near Chicago.

The findings from the Iowa studies may be summarized somewhat as follows:

(1) The Binet IQ of children from generally superior homes rose markedly during a period in nursery school, but did not rise during the summer spent in the general home environment (105).

(2) Performance on the Merrill-Palmer test showed some residual gain, after nursery school attendance, over and above apparent adaptation effects, but the influence was not as marked as for the Binet (108).

(3) The gains in Binet IQ were maintained by a sample of children located and tested after several years of attendance at other than University schools (106).

(4) The gains in Binet IQ were further added to by a sample of children who remained in the University schools and were tested at a later time (106).

(5) Length of attendance at the University schools was related to intelligence test score in high school and at college entrance (107).

(6) Gain from attending preschool was not related to the occupational level of the parent (12).

(7) The greatest gain in preschool was for those who originally received the lowest scores, and the smallest gain, for those who received the highest (105).

(8) In an orphanage preschool, attendance of 200 days or more resulted in some gain in Binet IQ, whereas a control group exposed to the general orphanage environment for this same length of time showed some loss in IQ (94).

The study by Kawin and Hoefer (44) failed to confirm the gains found in the Iowa studies. It was found that the gains in Merrill-Palmer score made by the nursery school group and the paired control group were substantially identical. These gains were attributed to practice.

There seems to be little question as to the genuineness of the immediate gains in Binet IQ in the Iowa preschool studies. However, before we accept the conclusion that gains so produced are permanent and lasting, it might be well to consider certain other explanations of their apparent permanence. The permanence of the

gains is inferred from conclusions (3) and (4) above. Before the lasting rise is definitely assigned to the nursery school experience, there are three other possible factors which should be considered:

(1) There is a possibility of selection. If we admit that there is a considerable element of chance in the score which a young child will make upon an intelligence test, we must agree that those children who test at 100 IQ, for example, cover quite a range in underlying "true" ability. Some have been overestimated in our testing and some underestimated. If there is a tendency for those who have been overestimated—whose "true" IQ is below 100 and who will consequently tend to drop on later tests—to be eliminated from the population which is retested, we may expect the fraction of the original population to whom we give retests to gain in IQ.

(2) Though these children did not gain between sessions of nursery schools, there is still the possibility that the sudden gain during nursery school represents a short-circuiting of a gain that would have appeared gradually over the years as a result of a generally superior home environment. That is, if the people who send their children to nursery school are people who will provide generally good and stimulating homes for their children, the sudden gains which appeared during nursery school and were subsequently maintained might have appeared as a slow cumulative development in the home environment. This would assume a temporary nursery school effect, sudden and gradually wearing off, balanced by a more permanent home effect, gradually making itself manifest.

(3) It may be that children from the genetic background represented by the University nursery school groups tend to do better on the type of intelligence tested at the older ages than on the type tested in the first few years. In this case, then, the permanent change would be explained as due to a change in the character of the test with the older children to a test upon which they were, by genetic constitution, more extreme deviates than they were upon the early tests.

It must be admitted that we do not have much evidence to back up any of these suggestions. However, it does not seem that they are excluded as possibilities.

Peterson's study (79), which compares a small group of nursery school children with another small group of non-nursery-school children as they enter and go through kindergarten, may be cited as suggesting that the intellectual increment for nursery school children at kindergarten age is not great. Only a small and diminishing superiority was found for the nursery school group when they were

compared with non-nursery-school children of comparable socio-economic status.

A rather vitriolic critique of Wellman's conclusions has been published by Simpson (89). Specific criticisms are directed primarily at the first of Wellman's publications (104).

Lamson (46) endeavors to determine to what extent intelligence quotients are increased by children who participate in what is described as "a vital curriculum—one that considers children's interests and capacities, that requires activity and self-direction on the part of children, and that makes progress at the child's own optimum rate possible." No evidence of gain is found in this school.

Studies by Hawthorne (34), by Lowry (59), and by Scruggs (86) investigate the effect of special training in reading upon intelligence test performance. Hawthorne found that pupils from 5 to 12 years of age, who were of average intelligence, but retarded in reading, and who had improved in reading during remedial instruction at twice the normal rate, showed no corresponding improvement on a group intelligence test. Lowry, on the other hand, found that 50 children who were given three months of intensive reading drill, which produced an average gain of 1.36 grades in five reading tests and 2.72 grades in two speed-of-reading tests, showed a gain from a pre-test on Form A to a post-test on Form B of the Otis Intermediate Examination of 11.76 points in IQ. There was no control group to take care of practice effects or possible inequality of standardization of the two tests.

Scruggs (86) also finds gains in intelligence from special reading instruction. A group of fifth-grade negro children who "followed an especially prepared course in reading involving intensive and extensive work . . . exercises in vocabulary development, following directions, fact getting, recognition of central thought, organization and summarization, rate and speed of reading and in manipulation" gained more than a control group on a variety of verbal and non-verbal intelligence tests. There is reported to be some residual gain a year and two years later.

Durrell (20) finds that children whose reading ability is better than would be expected from their Binet IQ do better on paper-and-pencil intelligence tests than on the Binet.

Conditions of Testing

Finally, we shall make brief mention of a number of studies which indicate the effect of certain conditions of testing upon the constancy of the resulting IQ's.

Madsen (61) and Jordan (42) report on the reliability of Binet tests given by student examiners, reporting test-retest correlations ranging from .65 to .84.

Mayer (65) and Rust (82) study the effect of negativism upon the scores of young children.

Adkins (1), Dave (16), Lämmermann (45), and Snedden (97) report evidence of practice effects where the same test is repeated or another test is given after a brief interval.

Benton (7), Ferguson (23), and Maller and Zubin (62) report studies in which special incentives were introduced into the testing situation. In no case did the special incentives result in significant increases in score, as compared to a control group.

Cattell (11) gives evidence of the variation in standard between different trained examiners.

Canady (9) reports a small-scale investigation of the effect of race of examiner upon test performance, comparing the performances of white and negro children tested by white and negro examiners.

Lodge (56) reports evidence of seasonal fluctuation in IQ. Analyzing results for a group of children living in their own home environment, tested at six-month intervals, he finds that tests given between November 1 and April 30 tend to be higher than those given during the other half of the year. It is suggested that some of the apparent preschool effect may be due to such a seasonal variation.

BIBLIOGRAPHY

1. Adkins, D. C. The effects of practice on intelligence test scores. *J. educ. Psychol.*, 1937, **28**, 222–231.
2. Arthur, G. The prediction value of the Kuhlmann-Binet scale for inmates of a State school for the feebleminded. *J. appl. Psychol.*, 1933, **17**, 188–194.
3. Arthur, G. The predictive value of the Kuhlmann-Binet scale for a partially Americanized school population. *J. appl. Psychol.*, 1937, **21**, 359–364.
4. Asher, E. J. The inadequacy of current intelligence tests for testing Kentucky mountain children. *J. genet. Psychol.*, 1935, **46**, 480–486.
5. Balken, E. R., & Maurer, S. Variations in psychological measurements associated with increased vitamin B complex feeding in young children. *J. exp. Psychol.*, 1934, **17**, 85–92.
6. Bayley, N. Mental growth during the first three years. *Genet. Psychol. Monogr.*, 1933, **14**, 1–92.
7. Benton, A. L. Influence of incentives upon intelligence test scores of school children. *J. genet. Psychol.*, 1936, **49**, 494–497.
8. Brown, R. R. The time interval between test and re-test in its relation to the constancy of the intelligence quotient. *J. educ. Psychol.*, 1933, **24**, 81–96.

9. CANADY, H. G. The effect of "rapport" on the I.Q.: a new approach to the problem of racial psychology. *J. Negro Educ.*, 1936, **5**, 209–219.
10. CATTELL, P. Do the Stanford-Binet IQ's of superior boys and girls tend to decrease or increase with age? *J. educ. Res.*, 1933, **26**, 668–673.
11. CATTELL, P. Stanford-Binet IQ variations. *Sch. & Soc.*, 1937, **45**, 615–618.
12. COFFEY, H. S., & WELLMAN, B. L. The role of cultural status in intelligence changes of preschool children. *J. exp. Educ.*, 1936, **5**, 191–202.
13. CRISSEY, O. L. Mental development as related to institutional residence and educational achievement. *Univ. Ia Stud. Child Welf.*, 1937, **13**, No. 1.
14. CRISSEY, O. L. The mental development of children of the same IQ in differing institutional environments. *Child Develpm.*, 1937, **8**, 217–220.
15. CUNNINGHAM, B. V. Infant IQ ratings evaluated after an interval of seven years. *J. exp. Educ.*, 1934, **3**, 84–87.
16. DAVE, K. J. Effects of practice upon intelligence tests. *Brit. J. educ. Psychol.*, 1938, **8**, 313.
17. DAVIDSON, C. M. Permanency of mental alertness measures. *J. appl. Psychol.*, 1938, **22**, 307–310.
18. DAWSON, S. Environmental influence on mentality. *Brit. J. Psychol.*, 1936, **27**, 129–134.
19. DRISCOLL, G. P. The developmental status of the preschool child as a prognosis of future development. *Child Develpm. Monogr.*, 1933, No. 13.
20. DURRELL, D. D. Influence of reading ability on intelligence measures. *J. educ. Psychol.*, 1933, **24**, 412–416.
21. ENGEL, A. M. Constancy of I.Q.; experiments with mental defectives. *Nation's Sch.*, 1937, **19**, 19–21.
22. ENGLISH, H. B., & KILLIAN, C. D. The constancy of the IQ at different age levels. *J. consult. Psychol.*, 1939, **3**, 30–32.
23. FERGUSON, H. H. Incentives and an intelligence test. *Aust. J. Psychol. Phil.*, 1937, **15**, 39–53.
24. FORAN, T. G. The constancy of the intelligence quotient; a review. *Cath. Univ. Amer. educ. Res. Bull.*, 1926, **1**, No. 10.
25. FORAN, T. G. A supplementary review of the constancy of the intelligence quotient. *Cath. Univ. Amer. educ. Res. Bull.*, 1929, **4**, No. 9.
26. FRITZ, M. F. The effect of diet on intelligence and learning. *Psychol. Bull.*, 1935, **32**, 355–363.
27. FURFEY, P. H., & MUEHLENBEIN, J. The validity of infant intelligence tests. *J. genet. Psychol.*, 1932, **40**, 219–223.
28. GARRISON, S. C. Retests on adults at an interval of ten years. *Sch. & Soc.*, 1930, **32**, 326–328.
29. GESELL, A., AMATRUDA, C. S., CASTNER, B. M., & THOMPSON, H. Biographies of child development. New York: Hoeber, 1939.
30. GILDEA, H., & MACOUBREY, C. Factors affecting the constancy of the intelligence quotients of problem children. *Smith Coll. Stud. soc. Work*, 1933, **3**, 229–247.
31. GOODENOUGH, F. L. The Kuhlmann-Binet tests for children of school age: a critical study and evaluation. Minneapolis: Univ. Minnesota Press, 1928.
32. HALES, W. M. Results of a group intelligence re-test with a reformatory group. *J. juv. Res.*, 1937, **21**, 181–187.

33. HALLOWELL, D. K. Stability of mental test ratings for preschool children. *J. genet. Psychol.*, 1932, **40**, 406–421.
34. HAWTHORNE, J. W. The effect of improvement in reading ability on intelligence test scores. *J. educ. Psychol.*, 1935, **26**, 41–51.
35. HERRING, A. An experimental study of the reliability of the Bühler baby test. *J. exp. Educ.*, 1937, **6**, 147–160.
36. HINTON, R. T., JR. The effect of a constant and superior environment upon the I.Q.'s of one hundred and seventeen children. (Abstract.) *Psychol. Bull.*, 1938, **35**, 681.
37. HIRSCH, N. D. M. Experimental study upon three hundred school children over a six-year period. *Genet. Psychol. Monogr.*, 1930, **6**, 487–549.
38. HOAKLEY, Z. P. The variability of intelligence quotients. *Proc. Amer. Ass. Stud. Feeblemind.*, 1932, **37**, 119–146.
39. HOLLINGWORTH, L. S., & KAUNITZ, R. M. The centile status of gifted children at maturity. *J. genet. Psychol.*, 1934, **45**, 106–120.
40. HONZIK, M. P. The constancy of mental test performance during the preschool period. *J. genet. Psychol.*, 1938, **52**, 285–302.
41. HUBBARD, R. M. A study of the reliability and validity of the Bühler infant scale. *J. genet. Psychol.*, 1935, **47**, 361–384.
42. JORDAN, J. S. Reliability of Stanford-Binet intelligence quotients derived by student examiners. *J. educ. Res.*, 1932, **26**, 295–301.
43. KAWIN, E. Children of preschool age. Chicago: Univ. Chicago Press, 1934.
44. KAWIN, E., & HOEFER, C. A comparative study of a nursery-school versus a non-nursery-school group. Chicago: Univ. Chicago Press, 1931.
45. LÄMMERMANN, H. Die Konstanz die Uebbarkeit von Denkleistungen. *Z. angew. Psychol.*, 1934, **46**, 3–87.
46. LAMSON, E. E. To what extent are intelligence quotients increased by children who participate in a rich, vital school curriculum? *J. educ. Psychol.*, 1938, **29**, 67–70.
47. LAUDERBACH, J. C., & HAUSE, E. On the reliability and validity of derived scores yielded by the McCall multi-mental scale. *J. appl. Psychol.*, 1932, **16**, 322–323.
48. LEAHY, A. M. Nature-nurture and intelligence. *Genet. Psychol. Monogr.*, 1935, **17**, 236–308.
49. LINCOLN, E. A. Preliminary report on the Stanford Binet IQ changes of superior children. *J. exp. Educ.*, 1933, **1**, 287–292.
50. LINCOLN, E. A. The Stanford Binet IQ changes of superior children. *Sch. & Soc.*, 1935, **41**, 519–520.
51. LINCOLN, E. A. A study of changes in the intelligence quotients of superior children. *J. educ. Res.*, 1935, **29**, 272–275.
52. LINCOLN, E. A. Stanford-Binet IQ changes in the Harvard growth study. *J. appl. Psychol.*, 1936, **20**, 236–242.
53. LINCOLN, E. A., & WADLEIGH, V. L. Change and constancy in group test I.Q.'s. *Sch. & Soc.*, 1932, **35**, 606–608.
54. LITHAUER, D. B., & KLINEBERG, O. A study of the variation in IQ of a group of dependent children in institution and foster home. *J. genet. Psychol.*, 1933, **42**, 236–242.
55. LIVESAY, T. M. Does test intelligence increase at the college level? *J. educ. Psychol.*, 1939, **30**, 63–68.

56. LODGE, T. Variation in Stanford-Binet IQ's of pre-school children according to the months in which examinations were given. *J. Psychol.*, 1938, **6**, 385–395.
57. LORGE, I. Retests after ten years. *J. educ. Psychol.*, 1934, **25**, 136–141.
58. LORGE, I., & HOLLINGWORTH, L. S. Adult status of highly intelligent children. *J. genet. Psychol.*, 1936, **49**, 215–226.
59. LOWRY, E. Increasing the I.Q. *Sch. & Soc.*, 1932, **35**, 179–180.
60. LUDEMAN, W. W., & MCANELLY, J. R. Intelligence of colony people. *J. educ. Psychol.*, 1930, **21**, 612–615.
61. MADSEN, I. N. Reliability and validity of Stanford-Binet tests when administered by student examiners. *J. educ. Res.*, 1934, **28**, 265–270.
62. MALLER, J. B., & ZUBIN, J. The effect of motivation upon intelligence test scores. *J. genet. Psychol.*, 1932, **41**, 136–151.
63. MASTERS, H. V., & UPSHALL, C. C. Study of the gains made by normal-school students in intelligence test scores. *J. educ. Res.*, 1934, **27**, 446–452.
64. MATEER, F. Pituitary acceleration of IQ's. (Abstract.) *Psychol. Bull.*, 1934, **31**, 686.
65. MAYER, B. A. Negativistic reactions of pre-school children on the New Revision of the Stanford-Binet. *J. genet. Psychol.*, 1935, **46**, 311–334.
66. MCCONNELL, T. R. Change in scores on the psychological examination of the American Council on Education from freshman to senior year. *J. educ. Psychol.*, 1934, **25**, 66–69.
67. MCNEMAR, Q. On the inadequacy of the reliability coefficient when used with I.Q. data. (Abstract.) *Psychol. Bull.*, 1936, **33**, 779–780.
68. MILLER, E. A. Emotional factors in intellectual retardation. *J. ment. Sci.*, 1933, **79**, 614–625.
69. MILLER, W. S. Variation of IQ's obtained from group tests. *J. educ. Psychol.*, 1933, **24**, 468–474.
70. MOWRER, W. M. C. Intelligence scales for preschool children. *Child Develpm.*, 1933, **4**, 318–322.
71. NELSON, V. L., & RICHARDS, T. W. Studies in mental development: I. Performance on Gesell items at six months and its predictive value for performance on mental tests at two and three years. *J. genet. Psychol.*, 1938, **52**, 303–325.
72. NELSON, V. L., & RICHARDS, T. W. Studies in mental development: III. Performance of twelve-months-old children on the Gesell schedule, and its predictive value for mental status at two and three years. *J. genet. Psychol.*, 1939, **54**, 181–191.
73. NEMZEK, C. L. Is the I.Q. constant? *Peabody J. Educ.*, 1931, **9**, 123–124.
74. NEMZEK, C. L. The constancy of the IQ's of gifted children. *J. educ. Psychol.*, 1932, **23**, 607–610.
75. NEMZEK, C. L. The constancy of the I.Q. *Psychol. Bull.*, 1933, **30**, 143–167.
76. O'NEILL, H. O. Variations in the intelligence quotients of 105 children. *Child Develpm.*, 1937, **8**, 357–363.
77. PARKER, H. T. Fluctuations in the intelligence quotients of subnormal children. *J. juv. Res.*, 1934, **18**, 163–168.
78. PARKER, H. T. The development of intelligence in subnormal children. *Aust. Coun. educ. Res. Ser.*, 1934, No. 27.

79. PETERSON, T. J. A preliminary study of the effects of previous nursery school attendance upon five-year-old children entering kindergarten. *Univ. Ia Stud. Child. Welf.*, 1938, **14**, 197–248.
80. POULL, L. E. The effect of improvement in nutrition on the mental capacity of young children. *Child Develpm.*, 1938, **9**, 123–126.
81. RICHEY, A. The effects of diseased tonsils and adenoids on intelligence quotients of 204 children. *J. juv. Res.*, 1934, **18**, 1–4.
82. RUST, M. M. The effect of resistance on intelligence test scores of young children. *Child Develpm. Monogr.*, 1931, No. 6.
83. SCHELL, M. Infection by intestinal protozoa in relation to the intelligence of siblings. *Child Develpm.*, 1933, **4**, 253–258.
84. SCHOTT, E. L. Variability of mental ratings in retests of neuropsychiatric cases. *Amer. J. Psychiat.*, 1930, **10**, 213–227.
85. SCHOTT, E. L. IQ changes in foster home children. *J. appl. Psychol.*, 1937, **21**, 107–112.
86. SCRUGGS, S. D. Effect of improvement in reading upon the intelligence of negro children. *Bull. Educ., Univ. Kans.*, May, 1935. (Special issue.)
87. SEAGOE, M. V. An evaluation of certain intelligence tests. *J. appl. Psychol.*, 1934, **18**, 432–436.
88. SHERMAN, M., & KEY, C. B. The intelligence of isolated mountain children. *Child Develpm.*, 1932, **3**, 279–290.
89. SIMPSON, B. R. The wandering IQ: is it time for it to settle down? *J. Psychol.*, 1939, **7**, 351–367.
90. SKEELS, H. M. The relation of the foster home environment to the mental development of children placed in infancy. *Child Develpm.*, 1936, **7**, 1–5.
91. SKEELS, H. M. Mental development of children in foster homes. *J. genet. Psychol.*, 1936, **49**, 91–106.
92. SKEELS, H. M. Mental development of children in foster homes. *J. consult. Psychol.*, 1938, **2**, 33–43.
93. SKEELS, H. M., & FILLMORE, E. A. The mental development of children from under-privileged homes. *J. genet. Psychol.*, 1937, **50**, 427–439.
94. SKEELS, H. M., UPDEGRAFF, R., WELLMAN, B. L., & WILLIAMS, H. M. A study of environmental stimulation: an orphanage preschool project. *Univ. Ia Stud. Child Welf.*, 1938, **15**, No. 4.
95. SKODAK, M. The mental development of adopted children whose true mothers are feeble-minded. *Child Develpm.*, 1938, **9**, 303–308.
96. SKODAK, M. Children in foster homes. *Univ. Ia Stud. Child Welf.*, 1939, **16**, No. 1.
97. SNEDDEN, D. Practice effect. *J. educ. Res.*, 1931, **24**, 376–380.
98. STUTSMAN, R. Factors to be considered in measuring the reliability of a mental test, with special reference to the Merrill-Palmer scale. *J. educ. Psychol.*, 1934, **25**, 630–633.
99. SYMMES, E. F. An infant testing service as an integral part of a child guidance clinic. *Amer. J. Orthopsychiat.*, 1933, **3**, 409–430.
100. TERMAN, L. M., & MERRILL, M. A. Measuring intelligence: a guide to the administration of the new revised Stanford-Binet tests of intelligence. New York: Houghton Mifflin, 1937.
101. THORNDIKE, R. L. The effect of interval between test and retest on the constancy of the IQ. *J. educ. Psychol.*, 1933, **24**, 543–549.

102. TRAXLER, A. E. Reliability, constancy and validity of the Otis IQ. *J. appl. Psychol.*, 1934, **18**, 241–251.

103. UPDEGRAFF, R. The determination of a reliable intelligence quotient for the young child. *J. genet. Psychol.*, 1932, **41**, 152–166.

104. WELLMAN, B. L. Some new bases for interpretation of the I.Q. *J. genet. Psychol.*, 1932, **41**, 116–126.

105. WELLMAN, B. L. The effect of pre-school attendance upon the I.Q. *J. exp. Educ.*, 1933, **1**, 48–69.

106. WELLMAN, B. L. Growth in intelligence under differing school environments. *J. exp. Educ.*, 1934, **3**, 59–83.

107. WELLMAN, B. L. Mental growth from pre-school to college. *J. exp. Educ.*, 1937, **6**, 127–138.

108. WELLMAN, B. L. Intelligence of pre-school children as measured by the Merrill-Palmer scale of performance tests. *Univ. Ia Stud. Child Welf.*, 1938, **15**, No. 4.

109. WELLS, J., & ARTHUR, G. Effect of foster-home placement on the intelligence ratings of children of feebleminded parents. *Ment. Hyg., N. Y.*, 1939, **23**, 277–285.

110. WHEELER, L. R. The intelligence of East Tennessee mountain children. *J. educ. Psychol.*, 1932, **23**, 351–370.

111. WOLCOTT, W. Changes in Thorndike intelligence test scores at the end of the college course. *Sch. & Soc.*, 1933, **37**, 627–632.

112. WOODALL, C. S. Analysis of I.Q. variability. *Proc. Amer. Ass. Stud. Feeblemind.*, 1931, **36**, 247–262.

NOTES AND NEWS

DR. LETA S. HOLLINGWORTH, a member of the faculty of Teachers College, Columbia University, since 1916 and wife of Dr. H. L. Hollingworth, professor of psychology at Barnard College, Columbia University, died on November 27, at the age of 53, in the Columbia-Presbyterian Medical Center in New York City.

THE Midwestern Psychological Association will hold its annual meetings on May 3 and 4 with the department of psychology at the University of Chicago. Professor F. C. Kingsbury is acting as local chairman of the meetings.

The presidential address will be given by Professor J. P. Guilford, of the University of Nebraska. In addition, a full program of research papers and symposia is being scheduled by the Program Committee under Professor Fred McKinney, of the University of Missouri. Psychologists and others in related fields are cordially invited to attend.

THE department of child study at Vassar College has received a two-year grant from the General Education Board and a supplementary fund from the Josiah Macy, Jr., Foundation for research in the development of personality in young children. This work is under the direction of Dr. Mary Shattuck Fisher, chairman of the department, who is being assisted by Dr. L. Joseph Stone, research editor, and other members of the department. Plans for certain work in coöperation with Dr. Lyle H. Lanier, of the psychology department, are under discussion. There will be special emphasis on pictorial methods of presentation, and sound films summarizing case studies of normal children will be prepared for use in courses in child psychology and education. These will be made available through Professor Daniel Prescott, of the department of education at the University of Chicago, and the American Council on Education.

THE Committee on Scientific Aids to Learning, under the chairmanship of President Conant of Harvard, has made a grant to cover the cost of preparing a microfilm master negative, on the most expensive film, of sets of volumes of scientific and learned journals. This permits the nonprofit Bibliofilm Service to supply microfilm copies at the sole positive copy cost of one cent per page for odd volumes, or at a special rate of one-half cent per page for any 10 or more consecutive volumes, if properly copyable. The number of pages will be estimated on request to the American Documentation Institute, care of offices of Science Service, 2101 Constitution Avenue, Washington, D. C.

THE response to the announcement of the forthcoming publication of the *Abstract References of the Psychological Index* by the American Psychological Association has been encouraging. The *Abstract Refer-*

ences in conjunction with the *Psychological Index* serve as an extension of the *Psychological Abstracts* back to 1894 by giving references to abstracts, published in various periodicals, of 43% of the entire literature listed in the *Psychological Index* from 1928 back to 1894.

Since some institutions possessing the *Psychological Index* have not yet ordered the *Abstract References,* it is suggested that psychologists who will be likely to avail themselves of this research-aid inquire of their libraries whether a copy has been ordered. The price is nominal: $2.00 for the first part, containing over one-third of the material, and probably $3.00 for the second part, containing the rest. Address orders to Abstract References, 25 Claremont Avenue, New York City.